JANUARY
1956

FOUNDRY

A PENTON PUBLICATION

CASTINGS and the Turbine Engine

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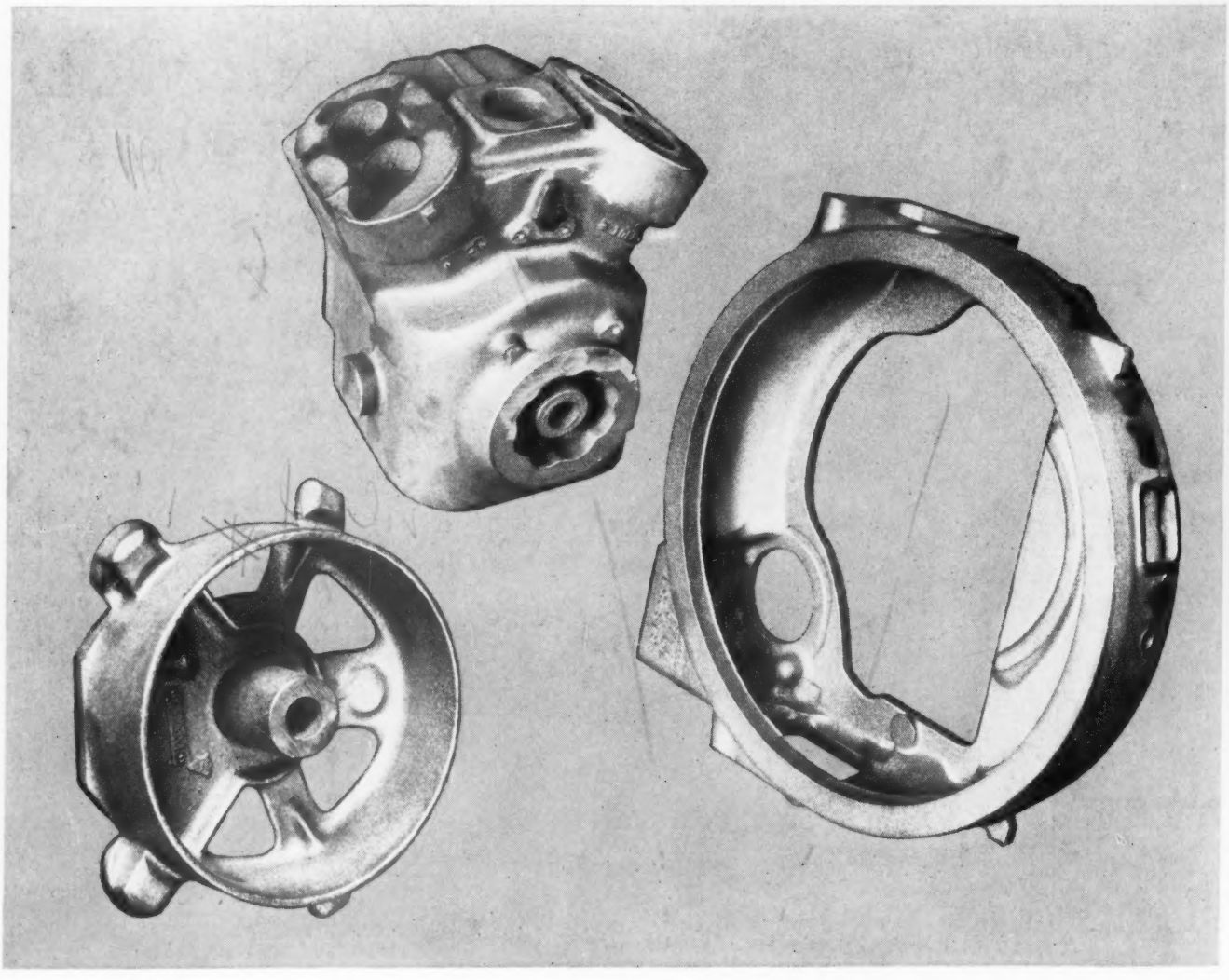
Q. How can YOU make BETTER GRAY IRON CASTINGS AT NO EXTRA COST ?



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Tech

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Cost of metal charge	$42.57 per net ton	$42.43 per net ton
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Misc. charges		.15
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SAVINGS (72 ton/250 days) per year **$32,040.00**

The Whiting-Thermo Hot Blast System employs a separate fired air heater, precisely controls air blast temperatures up to 1000°F. and makes available almost instant pre-heated air. Large savings in coke, silicon and fluxing agents are provided. The lining does not burn out over nearly as high an area as with cold blast—thus patching costs are reduced about 50%. Melting rates can be increased 10% to 15%, using the same diameter lining. Analysis is more uniform—fewer casting rejects. There is a reduction in oxidation of silicon and less sulphur pick up.

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specially selected and prepared for foundry use only

Back in 1925, bentonite was *first* developed, by FEDERAL, as an admix to molding and core sands. FEDERAL GREEN BOND was introduced at that time as *pure* bentonite of the highest quality, specially processed for foundry use. It's been just that ever since—unadulterated, untreated, free of chemicals or other ingredients detrimental to foundry sands or conditions. There are other reasons, too, for its superiority as a sand additive, such as:

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FEDERAL GREEN BOND contributes materially to the production of castings that are free of defects—castings that require much less cleaning—castings that look good and bring higher prices.

FEDERAL controls every phase of the production of GREEN BOND, from mining and processing to sales and technical service.

FEDERAL GREEN BOND is carried in stock in FEDERAL warehouses in principal cities in the U. S., Canada, British Isles and Continental Europe. It is available in *three* convenient forms: (1) PULVERIZED—for general foundry use as a dry additive, for core and molding sand. (2) GB-100 FINE GRANULAR—a dry additive with low dust content, for core and molding sand. (3) No. 1200 SLURRY GRADE GRANULAR—for use as a wet additive.

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FOUNDRY

A PENTON PUBLICATION

January 1956

Volume 84—Number 1

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(For addresses of branch offices, see page 273)

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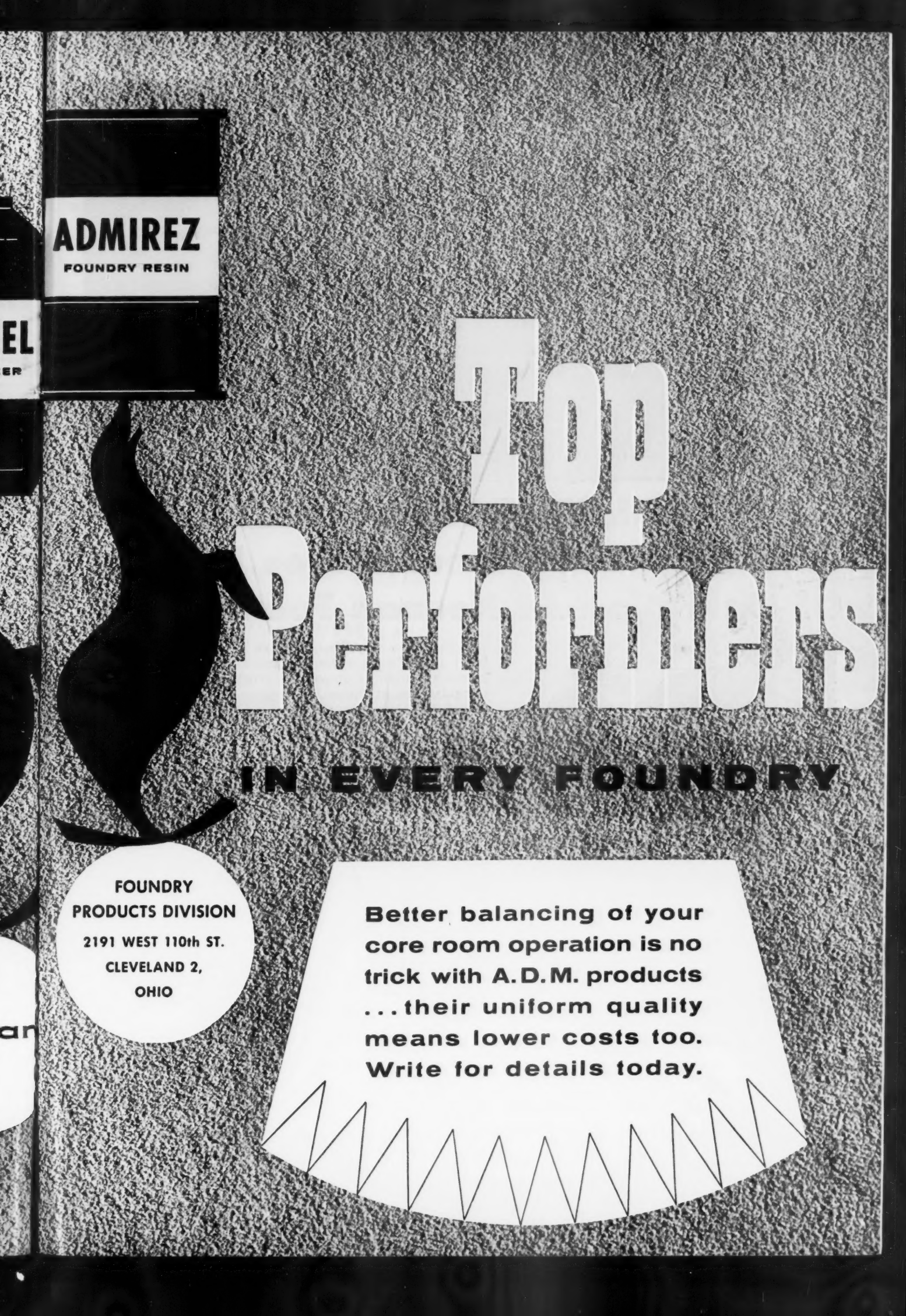
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ALLIS-CHALMERS FORK TRUCKS Give Over 6000 Trouble-Free Hours Of Operation At Neenah Foundry Co.

Neenah Foundry's chief mechanic, shown here at work on one of the Allis-Chalmers trucks with one of his men, has this to say about the superiority of this equipment: "They are tougher than the other trucks and require less maintenance. I like the overhead valves and wet cylinder sleeves. I think one reason the Allis-Chalmers trucks have out-performed the others is because they are easier to clean and service. I'm glad to see that they are replacing the old trucks with Allis-Chalmers trucks. This is going to make our job a lot easier."

For three years, Allis-Chalmers Fork Lift Trucks have been a part of a seventeen-truck fleet in operation at Neenah Foundry Company, a progressive, cost-conscious organization at Neenah, Wisconsin. During this time, the 4,000-pound capacity Allis-Chalmers trucks have been used continuously for handling heavy castings 10 to 12 hours per day. Yet because of their unusually sturdy construction, they have operated with only normal maintenance for well over **6,000 hours.** The rugged engines have required only normal tune-ups and oil changes, and are still in perfect running condition.

Moreover, the Allis-Chalmers trucks are doing a more efficient handling job, are operating on much less fuel, and are all but eliminating truck downtime and repair costs compared to the company's other equipment. **Brake lining and drum wear,** for example, always a serious problem because of fine foundry grit and sand, have been negligible—even after thousands of hours of operation.

Service and performance such as this—the rule, not the exception with Allis-Chalmers Lift Trucks—have made this equipment the choice of important foundries throughout the country.

Write today for your free copy of our 36-page, fact-filled booklet which explains in detail the many exclusive features making Allis-Chalmers Fork Lift Trucks industry's preference everywhere. BH-1

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can you use these *Facilities?*

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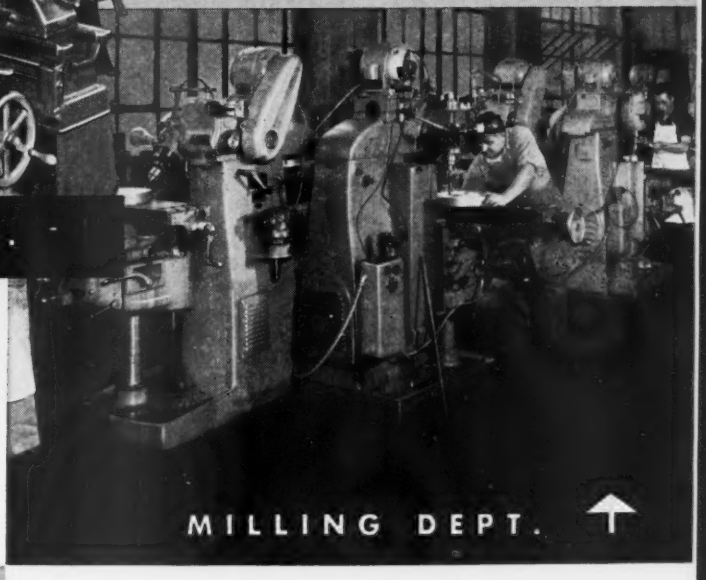

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...they're ready and able to serve you.

If you are looking for a reliable source for lathe work, milling and shaper work or non-ferrous castings (finish-machined or not) the chances are that City Pattern Foundry & Machine Company can fill the bill for you.

Each of these machining departments have a wide variety of modern equipment to handle almost any type of work that you might need. You'll find City Pattern Foundry and Machine Company an interested and economical source for both short and long runs.

In the foundry department you will find one of the most versatile and modern layouts in this part of the country. And, every conceivable laboratory control and testing device is on hand to insure chemical and physical specifications.

We will welcome the opportunity to give you more detailed information . . . won't you drop us a line or call in your specific requirements?

OUR NEW BROCHURE

Our colorful new brochure details our complete facilities for pattern work, foundry work and precision machining. Each department is completely illustrated with over forty recent illustrations. Your request will bring one to you promptly and without charge.

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HANDY SANDY . . .

beats a tough assignment in a prominent steel foundry

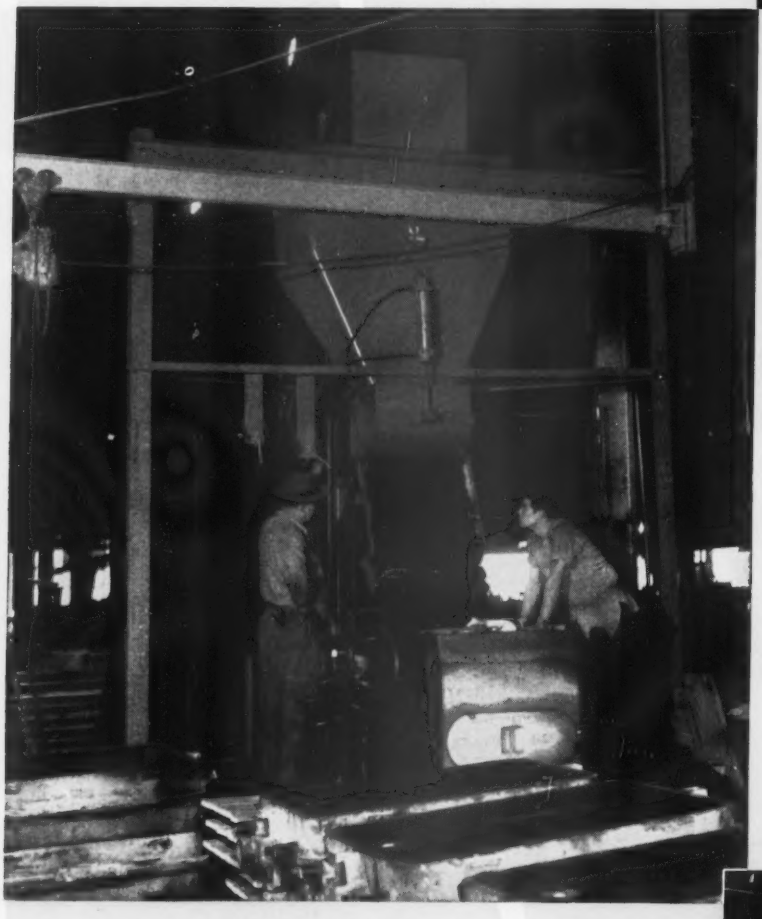

Photo above shows one of the Handy Sandys that provides sand for a large roll over machine.

Photo at right shows one of the Handy Sandys that provide overhead sand for a Cope and Drag operation. With this set-up three men are doing the work of four, and are producing 25% more molds per hour at a large reduction in molding costs.

Newaygo Handy Sandys are a "natural" for steel foundry molding operations. They are engineered like most Newaygo Foundry Equipment — to do a specific job, and do it better.

In this case, these special designed Handy Sandys include as standard equipment Belt-Type Elevators and a special Discharge Baffle on the elevator head to prevent sand from sticking at the discharge point. The overhead Aerator also has separate motor drives to give increased speed as well as aeration to the sticky sand. Removable, hardened aluminum lining is standard in the Overhead Hopper to assist proper flow of sand through the gate.

The two Handy Sandys in this foundry have been in operation for over six months. No trouble of any kind has been experienced in handling the sticky sand. No appreciable amount of maintenance has been required.

"Foundry Business is BIG Business"

Send for your copy of "Planned Mechanization for Foundries."

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. . . and profitable too, with NEWAY® MOLD HANDLING, SAND HANDLING AND CONDITIONING EQUIPMENT

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with H. V. ADAMS DESIGNED

HIGH EFFICIENCY FOUNDRY TOOLS

"UNIVERSAL FREE WHEELING"

FOUNDRY SAND RIDDLE

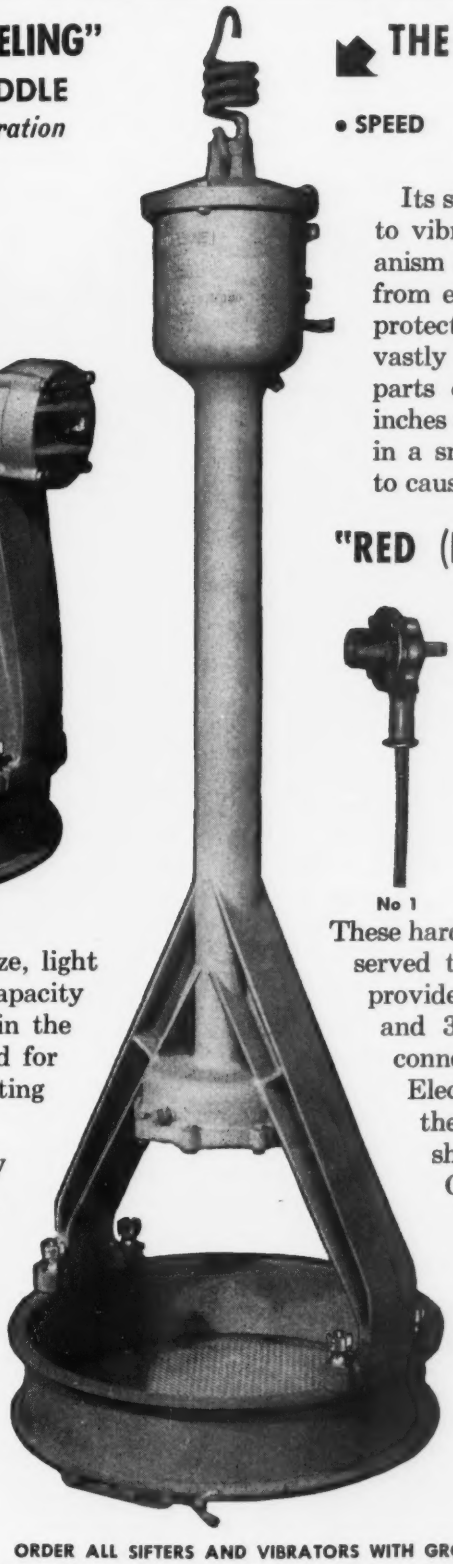
with the Double Eight Vibration

Because of its convenient size, light weight and good riddling capacity it long has been a favorite in the foundry. It also can be used for mixing core sand or for sifting sand directly into molds.

The mechanism is entirely enclosed protecting it from harmful dust and grit.

The main frame is cast in very strong tough aluminum.

It uses quick change ferruled sieves with 20 in. diameter sifting area. There are no loose wires to harm hands.



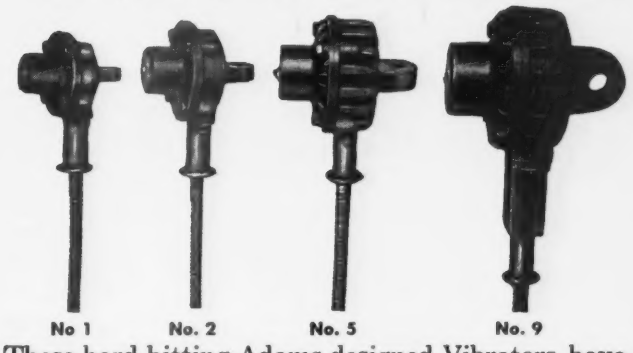
THE "ROTOPLANE" SPEED SIFTER

WILL GIVE YOU

• SPEED • ECONOMY • SAFETY • LONGER LIFE
• GREATER SIFTING CAPACITY

Its sturdy one-piece frame and long shaft add to vibration effectiveness. The sealed-in mechanism assures protection of motor and bearings from exposure to dust and grit. This sealed in protection and "Rotoplane's" free-rotary action vastly increase bearing life. No exposed moving parts endanger the operator. Sieves have 20 inches diameter clear sifting area—are mounted in a smooth steel ferrule with no jagged edges to cause dangerous cuts and scratches.

"RED (Devil) ELECTRIC" VIBRATORS



No 1 No. 2 No. 5 No. 9

These hard hitting Adams designed Vibrators have served the foundries for over 30 years. They are provided with a 6 foot 3 wire authorized cable and 3 wire grounded connector which, when connected with our 3 wire grounded Red Electric Knee Switch, automatically grounds the vibrator protecting the worker from shock. The vibrators have passed the U. S. Government code inspection.

Other Foundry Products:

- **No. 11 NOISELESS TYPE VIBRATOR**
- **A-20 ELECTRIC VIBRATOR**
- **RED ELECTRIC KNEE SWITCHES**
- **"ROTO" ADJUSTABLE BIN VIBRATOR**
- **2 MIN. UNIVERSAL FINENESS TEST SIFTER.**
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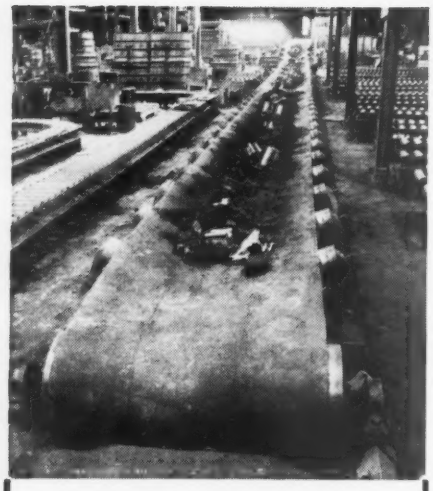


Imperial Belt gives 26 times expected life

Durability proven in destructive foundry service

Operators of the Riverside Foundry counted on only a month's service from belting used on the new conveyor pictured above.

They figured the destructive action of heat (300°-600° F.) from carrying "cherry-red" castings and hot sand, plus abrasion and gouging, would ruin any belt quickly.

However, the original belt, Imperial Super Insulated Sahara Armored (205′ x 42″ x 6 ply) was still in operation after 26 months at the last report.

Super-strong construction

Such outstanding service records are not unusual for Imperial INNERLOCKED* Belting. The base fabric, heavy-duty hard silver duck, has a tensile strength of over 750 lbs. per inch of width. INNERLOCKED* stitches prevent ply separation.

Exclusive Imperial impregnating compounds waterproof, lubricate, toughen and preserve the duck fabric. Metallic reinforcement gives Sahara Armored Belting maximum resistance to abrasion and impact.

Job-designed

Imperial Sahara Belts are job-designed to withstand temperatures to 600° F. Whatever your needs, Imperial Belting will give you lowest long-time operating costs. Write for Data Sheet 54-2 which describes the Imperial Belts for foundry service.

*INNERLOCKED—*Reg. trade name of Imperial Belting Co.*

You expect more from Imperial . . . and you get more!

Imperial BELTING CO.

1755 S. Kilbourn Ave., Chicago 23, Ill.

With the EDITORS

PRODUCTION PICKUP: For the foundry industry, 1955 was an interesting year. From the doldrums of 1954, the demand for castings moved forward until record or near record production in several castings industries marked the year just closed. When the totals are in, it is possible that the malleable castings industry will have set a new production record. Gray iron production probably will be the second best in history, and output of steel castings will be slightly under the total produced in 1953. Scarcity and price of metal handicapped the nonferrous foundry industry, but aluminum casting shipments set a new high record. Last year was a good foundry year, and it appears to many experts that 1956 will again provide equally high demands for cast products.

—o—

Progress: The industry continued to move forward during 1955 in the development of processes and promotion of products. Use of the shell molding process increased and much work has been evidenced in application of shell cores. The CO_2 process and use of cold setting binders for hardening cores have been tried in many foundries, and experimental study continues. Greater tonnages of pearlitic malleable and nodular iron were sold, much of which replaced components produced by other methods of fabrication. Pressure molding continues to expand, and greater use of permanent mold and die casting processes was recorded in the light metal foundries. Much in the way of new equipment and supplies has been introduced or is now in the experimental stage.

Undoubtedly the foundry industry goes into 1956 better prepared to supply the demand for better castings.

—o—

Better Ways, Better Castings: Recently I had the privilege of visiting the Laboratory of Whitehead Bros. Co. in New York and the Manufacturing Research Department of International Harvester Co. in Chicago.

The excellently equipped Whitehead laboratory provides a splendid illustration of how a producing foundry supplier can serve the industry by constantly searching for new and better products and at the same time controlling the quality of materials now being supplied to foundries.

The foundry laboratory maintained at the Manufacturing Research Building by International Harvester has been expanded three-fold since the first unit was dedicated in 1950. Now, an exceptionally fine foundry with much modern equipment is studying and developing casting practices and procedures for use in the company's foundries. Studies constantly are under way to further the use of castings in the extensive list of products made by the company.

Visiting these and other laboratories working on foundry problems surely gives confidence in the future growth and development of the foundry industry.

—o—

Time To Recruit: Foundries planning to hire a young engineer after he graduates next June *should be looking over the candidates now.* Recruiting by industry started at many engineering schools in November. And in view of the heavy demand for engineers, the supply likely will be exhausted by spring.

The Foundry Educational Foundation makes some good recommendations to foundries seeking graduate engineers. They include:

"Check with each university as to present policies regarding campus interviews.

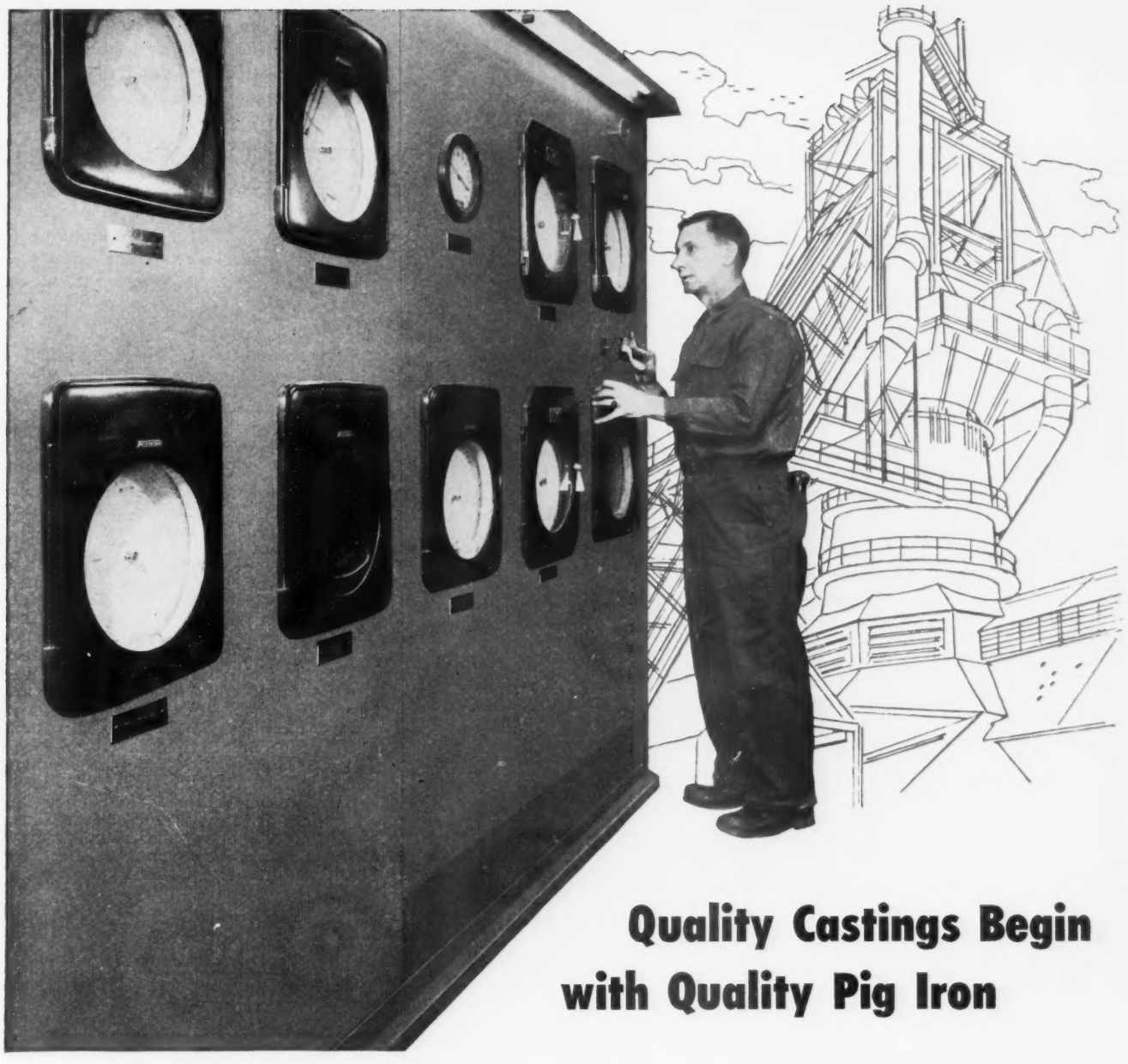
"Do not expect to enlist a prospective graduate unless you see him personally at his school or by a visit to your plant. Graduating engineers are being deluged with correspondence and personal visits. It will not be practical for a student to answer all mail approaches.

"Medium and small companies have attracted their share of the available engineering candidates. Personal contact by a company official is required.

"Summer work prospects can be contacted at the same time. This is one of the surest ways of interesting young men as future candidates for your organization."

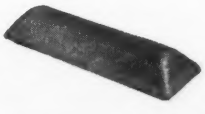
—o—

Safety Awards: My old home town newspaper, the *Plymouth (Ind.) Daily Pilot,* recently carried a photograph of H. K. McElroy, safety engineer, Michigan Mutual Liability Co., presenting a plaque to personnel of the Plymouth Foundry Co. for



Quality Castings Begin with Quality Pig Iron

THE quality of your gray iron castings depends on pig iron produced under controlled conditions. That's why we take special care in the production of Neville Pig Iron, day in and day out, year in and year out. Modern controls like those above, for example, enable us to maintain furnace temperatures and pressures within a cat's whisker of perfection. When you specify Neville Pig Iron, you're sure of uniform, close grain and the precise analysis you need. ● Why not let Neville Quality work on *your* side, just as dozens of well-known foundries do. We'll be glad to discuss your specific problems and requirements.



Neville Pig Iron and Neville Coke for the Foundry Trade

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IN NON-FERROUS FOUNDRIES

Provide the
Utmost in Speed
Production
and Safety

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BRASS • ALUMINUM • MAGNESIUM
AND ALL OTHER
NON-FERROUS ALLOYS

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300-320 MOORE ST. HARRISON, OHIO

an outstanding safety record during the past year. The Plymouth foundry, along with 14 other castings producers in Michigan and Indiana, had no lost-time accidents during the year.

The Slinger Foundry Co., Slinger, Wis., recently received a bronze plaque from the Bituminous Casualty Co. for excellence in accident prevention. Thirty-five employees received merit awards for completing from one to ten years without a lost time accident.

—o—

Technical Only: As an old technical grad, I rather liked the following story and comment of Summerfield Brunk, president of Headford Bros. & Hitchins Foundry Co., Waterloo, Iowa:

The story has been told many times —that of the Englishwoman in India who wished to have some electric outlets installed.

She called by telephone to an electrical contracting firm, and not long after a native electrician appeared at her home. She showed him where the first outlet should be installed and when he had accomplished the task he appeared before her for instructions as to the location of the next.

Three times this occurred. Finally she said, 'For goodness sake, man, just use common sense.'

His reply was 'Memsahib, common sense is a gift of the gods and I have only a technical education.'

There are many times, I fear, that, as was true of the electrician, I may be possessed of a technical education but have been slighted by the gods.

—o—

Memorial: The Institute of British Foundrymen, St. John Street, Chambers, Deansgate, Manchester 3, England, is collecting contributions to a fund which will be used to establish a Tom Makemson Memorial. The memorial will take the form of an annual award of the Tom Makemson Bronze Medal and Prize to the best student in the final patternmaking examination of the City and Guilds of London Institute. American foundrymen will recall that Mr. Makemson for many years was the efficient and admired secretary of the IBF, the secretary of the International Committee of Technical Associations and a visitor to several International Foundry Congresses held in this country. Contributions will be gratefully accepted.

—o—

Happy New Year: To our splendid contributors, to our many advertisers, and to our faithful readers, the editorial and advertising staffs extend best wishes for a happy and prosperous New Year. May 1956 continue the upward trend in castings demand that developed during 1955. F.G.S.

another reason for your confidence in AC Ingots...

ALUMINUM ALLOY INGOTS

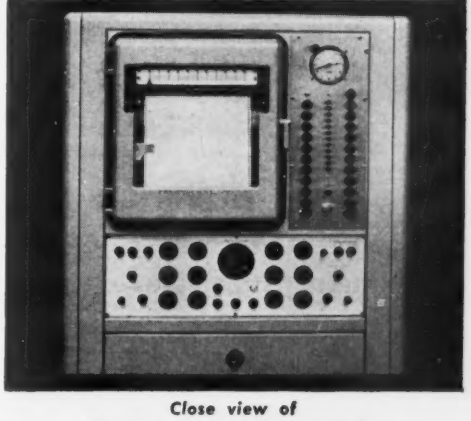
NOW QUALITY CONTROLLED BY QUANTOMETER

SPECTROCHEMICAL ANALYSIS

- **Measures complete, exact alloy composition**
- **Most precise, most rapid method available — permits constant sampling**
- **Used also to select alloy metals**

Now AC provides additional control in the quality of aluminum casting alloys—quality control by Quantometer. The Quantometer affords the fullest measure of chemical control. It is a spectrometer enabling faster, more accurate analyses of alloy composition. This advance replaces ordinary chemical procedures which are subject to human error; its speed permits constant sampling.

Let AC specialists of proven ability help solve your ingot problems. No obligation, just call.



Close view of Quantometer Recording Console.

for quality Aluminum Ingots

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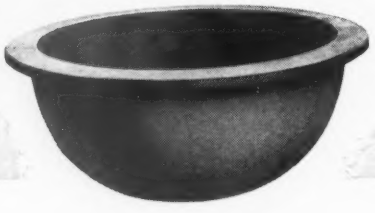

FOR FOUNDRYMEN!

Melting non-ferrous metals? You'll save with Acme melting pots and ingot molds. They require less frequent replacement because they're cast from a special iron formula that combines strength with the ability to withstand high temperatures. They improve production, too, because they're designed for even distribution of heat without hot spots. More than 30 years' experience in this field is your assurance of high quality in Acme melting pots and ingot molds . . . designed *by* foundrymen, *for* foundrymen.

Quick delivery anywhere in the United States. Write for size list showing 40 standard sizes.

Acme FOUNDRY CO.

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CALENDAR of Meetings

Jan. 20—Malleable Founders' Society, general meeting, Hotel Cleveland, Cleveland.

Jan. 23-26—Plant Maintenance & Engineering Show, Convention Hall, Philadelphia. Plant maintenance and engineering conference will be held concurrently with the show.

Jan. 24-27—American Management Association, general management conference, Hotel Fairmont, San Francisco.

Feb. 1-2—Midwest Welding Conference, cosponsored by Armour Research Foundation and Chicago section, American Welding Society, Illinois Institute of Technology, Chicago.

Feb. 6-9—Ventilation Conference, Michigan Department of Health and Michigan State University, Kellogg Center, Michigan State University, East Lansing, Mich.

Feb. 9-10—Wisconsin Regional Foundry Conference, Hotel Schroeder, Milwaukee.

Feb. 16-17—Southeastern Regional Foundry Conference, sponsored by Birmingham and Tennessee Chapters, AFS, Tutwiler Hotel, Birmingham.

Feb. 27-Mar. 2—American Society for Testing Materials, spring meeting, Hotel Statler, Buffalo, N. Y.

Mar. 7-8—Foundry Educational Foundation, college-industry conference, Hotel Cleveland, Cleveland.

Mar. 12-16—National Association of Corrosion Engineers, annual conference, Hotel Statler, New York.

Mar. 19-20—Steel Founders' Society, annual meeting, Drake Hotel, Chicago.

Apr. 3—Material Handling Institute, spring meeting, Edgewater Beach Hotel, Chicago.

Apr. 12-13—Malleable Founders' Society, annual market development conference, Edgewater Beach Hotel, Chicago.

Apr. 18-19—Armour Research Foundation, Illinois Institute of Technology, national industrial research conference, Hotel Sherman, Chicago.

May 3—Non-Ferrous Founders' Society, annual business meeting, dinner and reception, Marlborough-Blenheim Hotel, Atlantic City, N. J.

May 3-9—American Foundrymen's Society, annual convention and exhibition, Convention Hall, Atlantic City, N. J.

May 8-11—American Welding Society, spring meeting and 4th welding and allied industry exposition, Buffalo.

June 5-8—Material Handling Institute, exposition, Cleveland Public Auditorium, Cleveland.

June 11-12—Malleable Founders' Society, general meeting, The Homestead, Hot Springs, Va.

June 17-22—American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

July 17-30—Materials Handling Training Conference, Lake Placid, N. Y.

Sept. 1-9—Association of German Foundrymen, international foundry exhibition and trade fair, Dusseldorf, Germany.

Sept. 17-21—Instrument Society of America, instrument-automation conference and exhibit, Coliseum Bldg., New York.

Sept. 24-25—Steel Founders' Society of America, annual fall meeting, The Greenbrier, White Sulphur Springs, W. Va.

Sept. 24-26—Material Handling Institute, fall meeting, The Greenbrier, White Sulphur Springs, W. Va.

Oct. 11-12—National Foundry Association, annual meeting, Detroit.

Oct. 18-20—Foundry Equipment Manufacturer's Association, annual meeting, The Greenbrier, White Sulphur Springs, W. Va.

Oct. 30-Nov. 2—Gray Iron Founders' Society, annual meeting, The Homestead, Hot Springs, Va.

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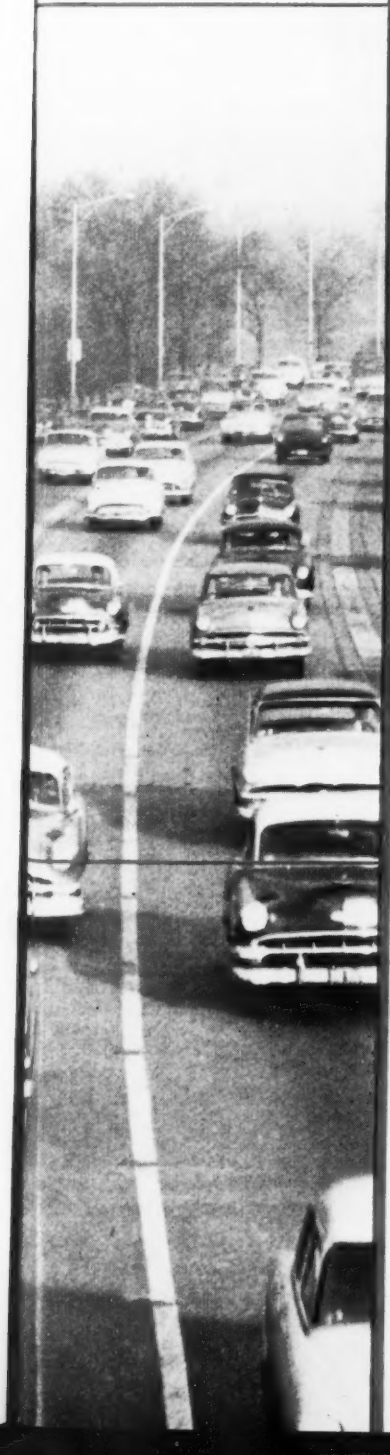
today's newest
automobiles



DEMMLER

The Oldest Name in Core Blowers

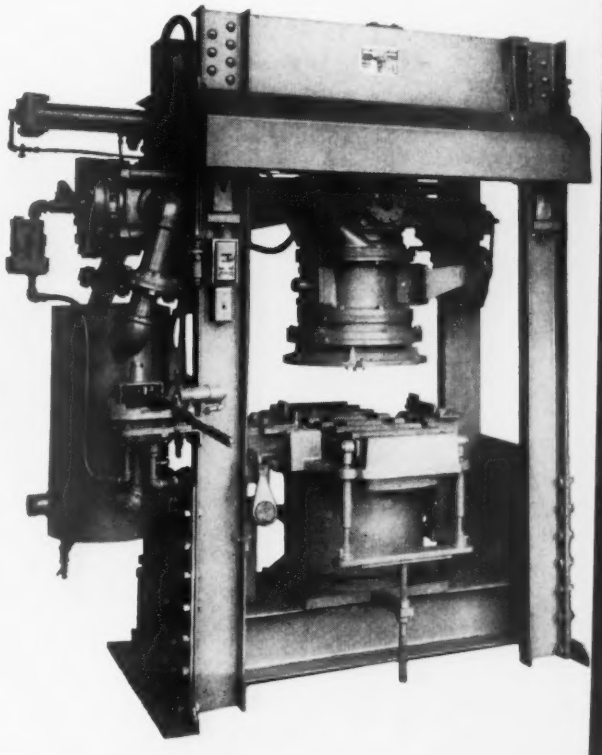
the DEMMLER 103

Since the days of the "horseless carriage" the name DEMMLER has meant the ultimate in fine core blowing machinery. Today — more than 45 years later — the modern Demmler 103 is meeting casting production demands of the nation's leading automobile manufacturers.

The Demmler 103 core blower is a stationary magazine type machine capable of blowing ANY core or molding sand into cores weighing up to 50 lbs. It is hard-blowing and extremely efficient. All air-operated, the 103 is carefully designed to minimize maintenance.

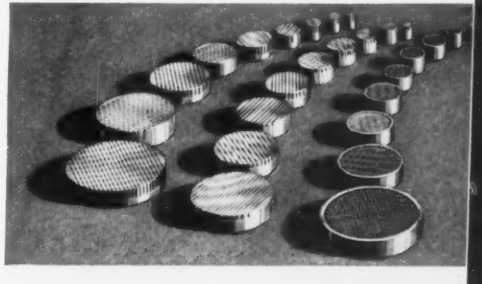
It's fast, too. The cycle of operation is 6 seconds maximum and it has produced as many as 2,000 cores per hour on a foundry production line.

The Demmler 103 can be equipped for fully automatic, semi-automatic or manual operation.



QUALITY - Built-into Every Core Box Vent

It's sound judgement to choose core box vents from a company which pioneered the manufacture of core blowers. Demmler engineers are constantly improving vent designs and developing new types. The HL 150 mesh vent, for example, is a special design for various applications including D-process shell molding. Brass-slotted, steel-slotted and screen types are available in sizes to meet every application.



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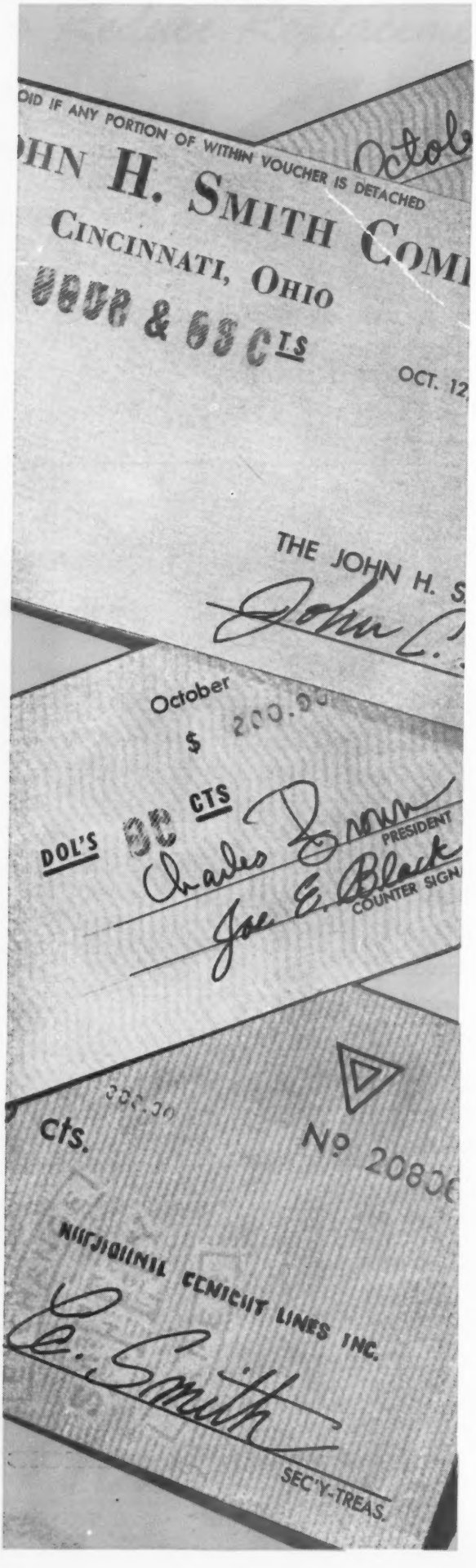

How to really cut costs in your cleaning room!

Switch to

CINCINNATI (PD) SNAGGING WHEELS

If your cleaning room costs are cutting into your profits, switch to CINCINNATI (PD) SNAGGING WHEELS—the greatest grinding wheel development in years! CINCINNATI (PD) WHEELS will absolutely cut your cleaning room costs . . . saving you money four important ways:

- LONGER WHEEL LIFE—Through longer life of CINCINNATI (PD) WHEELS, users have reported almost *double* the production per wheel. One customer, using a portable grinder, gets almost twice the life with a CINCINNATI (PD) Flared Cup. Another user, snagging cylinder blocks on a swing frame, has increased the production per wheel 45% with (PD) WHEELS.

- FREER CUTTING—You can get more pounds of metal per hour with the grains and bonds specified by CINCINNATI for your jobs. Operators like the fast, easy cutting action of CINCINNATI (PD) WHEELS.

- SELF-DRESSING ACTION—The CINCINNATI (PD) WHEELS specified by CINCINNATI abrasive engineers require few, if any, dressings. With the right grade wheel, new cutting grits are bared as soon as old grits get dull and inefficient.

- POSITIVE DUPLICATION (PD)—"On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet these better, cost-cutting CINCINNATI (PD) WHEELS *are priced no higher than ordinary wheels.*

CINCINNATI (PD) WHEELS are made in vitrified and resinoid bonds for both ferrous and non-ferrous foundries and are available in a complete variety of sizes and shapes.

We'll be happy to prove to you how CINCINNATI (PD) WHEELS can increase your production and cut your cleaning room costs. Just contact us and we'll send one of our representatives. Wire, write or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

CINCINNATI *Grinding Wheels*

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

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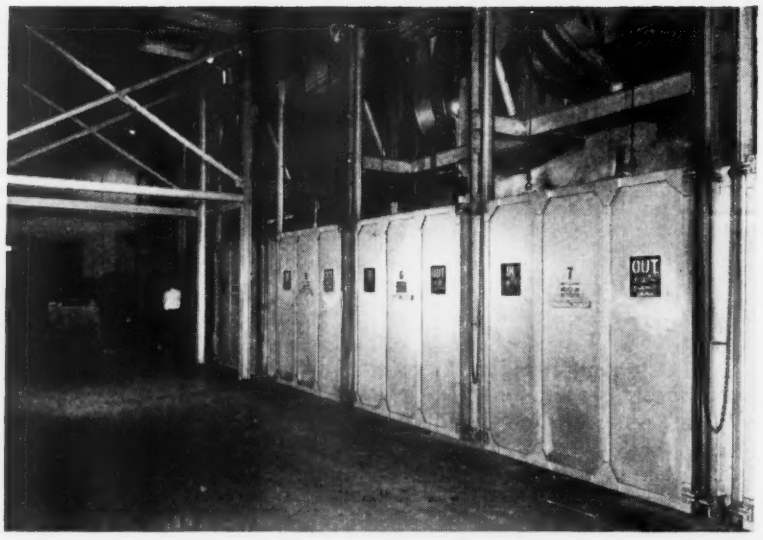
How much money can you really save using



Coleman Transrack Ovens

COLEMAN OVENS

in your core department?

Performance records in all classes of foundries prove that Coleman Ovens reduce overall core department costs by as much as 50%! In fact, many Coleman Ovens pay for themselves out of savings in less than a year!

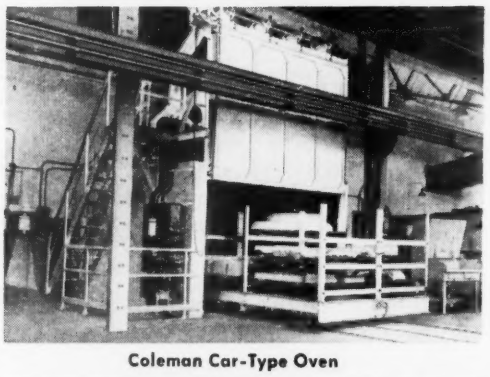
Coleman Core and Mold Ovens, through modern engineering and more than half a century of specialized foundry experience, have an outstanding record for reducing scrap losses, fuel, material and labor costs. The uniform heating, accurate controls and work handling methods found exclusively in Coleman Ovens are responsible for immediate improvement in cores, molds and casting quality.

Since production savings are so important to profits, it will pay you to investigate the unusual advantages of Coleman Ovens immediately. Let our experienced engineers show you how modern Coleman Ovens can pay dividends in your foundry.

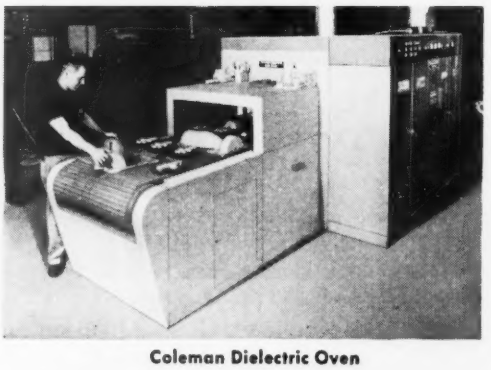
As builders of the world's only complete line of foundry ovens, we have no reason to recommend any but the best oven for your purpose.

WRITE FOR BULLETIN 54

Coleman Tower® Oven



Coleman Car-Type Oven



Coleman Dielectric Oven

A COMPLETE RANGE OF TYPES AND SIZES:

for every core baking and mold drying requirement:

Tower Ovens • Horizontal Conveyor Ovens • Car-Type Core Ovens • Car-Type Mold Ovens • Transrack Ovens • Rolling Drawer Ovens • Portable Core Ovens • Portable Mold Dryers • Dielectric Core Ovens

THE FOUNDRY EQUIPMENT COMPANY

1821 COLUMBUS ROAD CLEVELAND 13, OHIO

WORLD'S OLDEST AND LARGEST FOUNDRY OVEN SPECIALISTS

MEMBER FEMA

Now! TOCCO* Induction Melting Furnaces for Precision Casting

One of the TOCCO Induction Melting Furnaces used at Arwood Precision Casting Co. Note TOCCO control station in background.

● Engineers at Arwood Precision Casting Co. use TOCCO Induction Melting Furnaces for melting and remelting quality steel. Other companies have found TOCCO equally adaptable for melting non-ferrous metals. No wonder! *Look at the advantages:*

- ★ Stepless power control
- ★ Extremely Rapid Melting
- ★ High Efficiency on Intermittent Operation
- ★ Good Mixing because of Natural Agitation
- ★ Extremely Low Alloy Loss
- ★ No Carbon Pick-up
- ★ No Contamination when Composition of Charges is Changed
- ★ High Reproducibility of Results
- ★ Minimum Space Requirements
- ★ No Special Installation Charge
- ★ Simple, Safe Operation
- ★ Clean, Comfortable Working Conditions

If any of these advantages suggest economies in your operations write for full details—no obligation, of course.

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Please send copy of "The Case for TOCCO Induction Melting."

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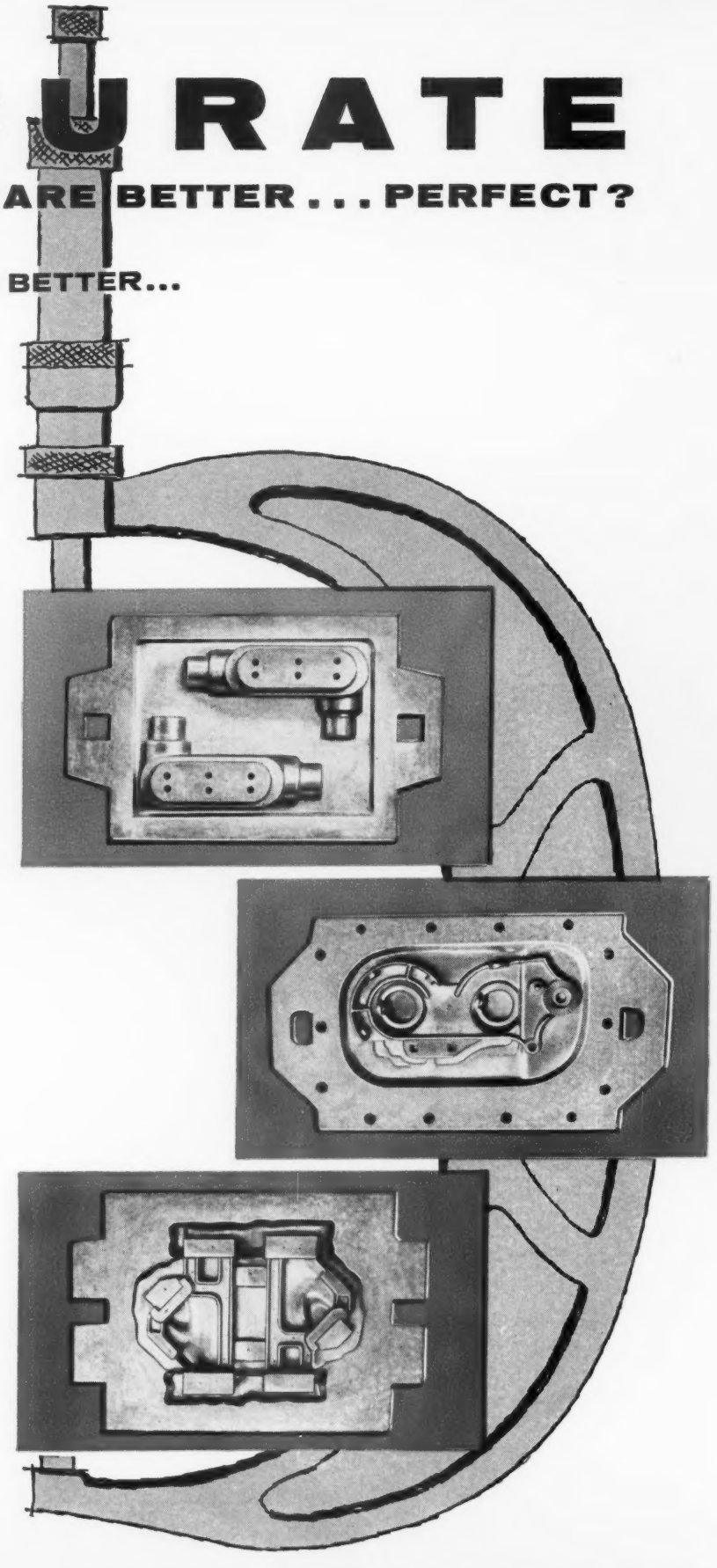
ACCURATE

MATCH PLATES ARE BETTER . . . PERFECT?

NO—BUT CONSISTENTLY BETTER...

Accurate match plates make good pattern work worth-while and in addition reduce overall cost.

Send us your master pattern—the one you're proud of, and get a plate that reflects your workmanship.



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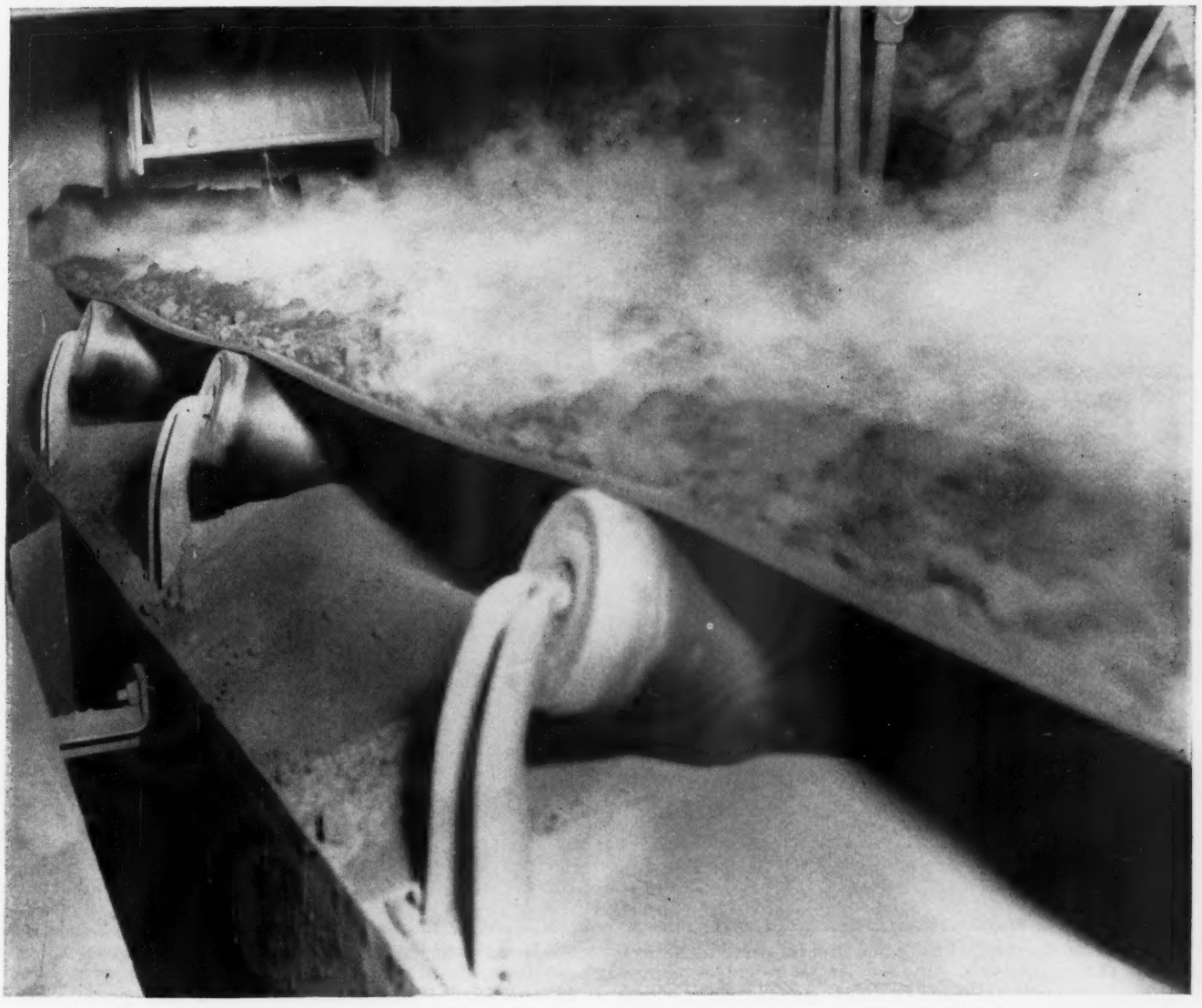
RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER



Too hot to handle but it travels on rubber

A typical example of B. F. Goodrich improvement in rubber

THAT moving rubber platform is carrying sizzling hot chunks of iron and sand in a foundry. The heat had been ruining belts in a few months.

Then the company heard that B. F. Goodrich had developed a special heat-resisting rubber that can stand hot materials that would char or burn ordinary rubber. They built this rubber into a belt. Then, for good measure, added a layer of nylon cords near the surface to help prevent damaging cracks in the cover.

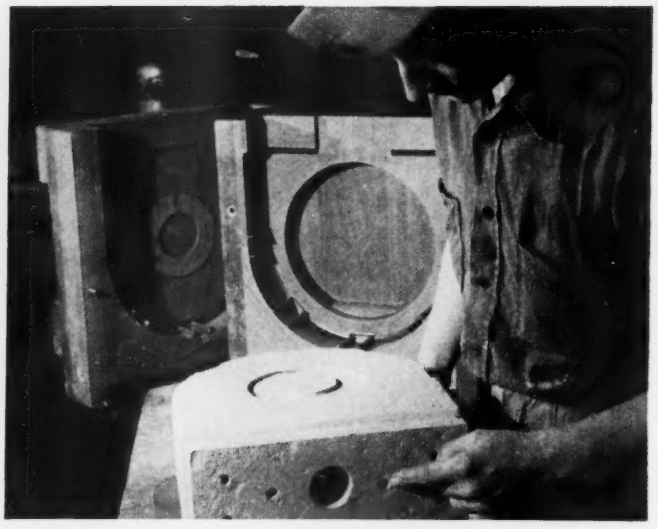
This improved B. F. Goodrich belt is what you see in the picture. It has already outlasted any other belt ever used here and looks good for double the life.

Product improvement is *always* going on at B. F. Goodrich. Some improvements are big, spectacular; some are little; many are too technical to explain easily, but all save you money. Every product gets its share—conveyor belts, V belts, every kind of hose, hundreds of others. None is ever regarded as "finished" or standardized.

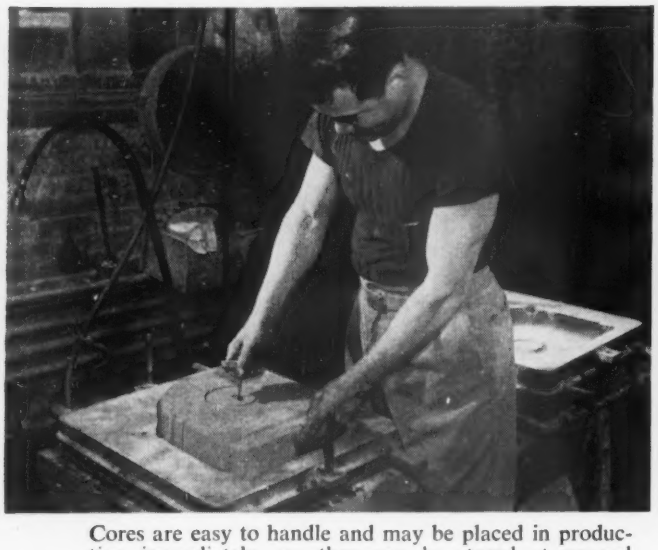
How this cuts your costs: Biggest cost savings come almost always from top performance rather than lowest prices. If you use rubber products, remember B. F. Goodrich is one company that will *never* lower its quality standards. This means you can be sure of top performance and real money savings. If you want this extra value, these lower costs year after year, always call your B. F. Goodrich distributor. Find out about the latest improvements or try out the latest and best types of any rubber products you buy. *The B. F. Goodrich Company, Dept. M-529, Akron 18, Ohio.*

B.F.Goodrich
INDUSTRIAL PRODUCTS DIVISION

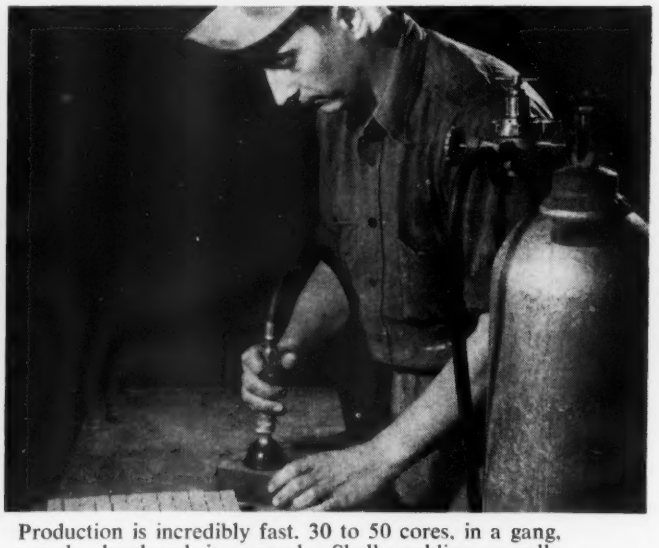
This process eliminates the use and cost of heavy equipment, and can be located anywhere in a foundry. It is ideal for shooting machines, shell molding and hand ramming.



Solid castings are assured. Cores harden in the core box and are not subject to deformation by handling and transporting. Extremely small tolerances can be maintained.



Cores are easy to handle and may be placed in production immediately, or, they can be stored at normal temperatures. Obnoxious fumes are eliminated. Sand recovery is excellent.



Production is incredibly fast. 30 to 50 cores, in a gang, can be hardened in seconds. Shell molding—usually complicated—is simple and inexpensive. Rejects caused by hot tear are reduced to a fraction.

Carbon Dioxide process hardens molds and cores in 5-to-15 seconds—eliminates ovens!

The carbon dioxide injection process is the first and only method of "baking" molds and cores without heat. Pureco CO_2 used in conjunction with specially prepared water glass binders can reward foundrymen with phenomenal savings in time, space, and capital investments while providing unprecedented flexibility. See your Pureco man for full information.

- **Eliminates baking ovens . . . saves time**
- **High dimensional stability of cores**
- **Fewer wires and core grids required**
- **No dry shells for cores**
- **Eliminates fumes when pouring**
- **Reduces rejects**

AT THE FRONTIERS OF PROGRESS YOU'LL FIND...

AN AIR REDUCTION PRODUCT

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A Division of Air Reduction Company, Incorporated

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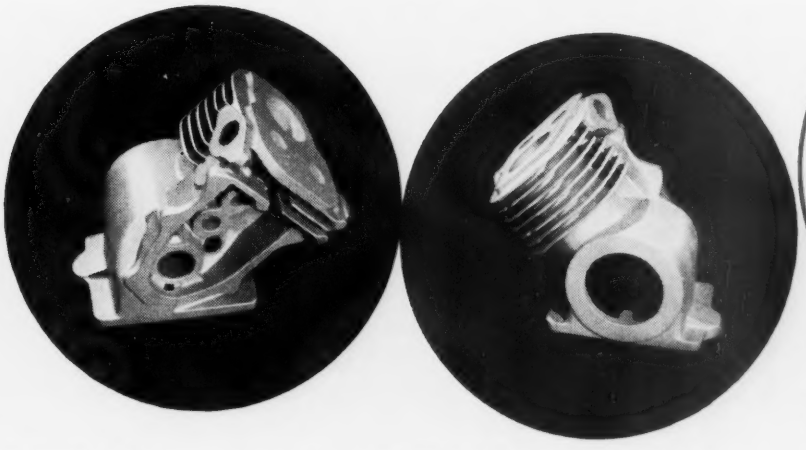
PURE CARBONIC COMPANY is a division of **AIR REDUCTION COMPANY, INCORPORATED** • Principal products of other divisions include: **AIRCO** — industrial gases, welding and cutting equipment and acetylenic chemicals • **OHIO** — medical gases and hospital equipment • **NATIONAL CARBIDE** — pipeline acetylene and calcium carbide • **COLTON** — polyvinyl acetates, alcohols and other synthetic resins.

Plenco shell molding resins and Brillion casting skill give Reo Power Mowers cost-saving improvements



TWO VIEWS of Reo Lawn Mower motor cylinder block showing improved result of shell molds made with Plenco #47 resin. Advantages obtained include: **1**—Better tool life and higher machining speeds due to clean smooth surface finish of casting. **2**—Cleaner intake and exhaust ports with shell cores, making possible a slight increase in the horsepower of the engine. **3**—Reduction in the number of rejections due to porosity in the cylinder wall or bore. **4**—Two holes cored; previously these holes were drilled into the solid casting. **5**—Locating pads held to closer tolerance, reducing machining scrap. **6**—All core areas cleaner and overall appearance greatly improved.

Reo Model TKS-21, Power Trim, Power Propelled Lawn Mower. Its 2¼ h.p. four cycle engine utilizes the engine block casting described here.

Shell molding eliminated 190 pounds of molding material in casting four of these 11-pound gray iron cylinder blocks for the engine of the Reo Power Lawn Mower. This economy was made possible by the precision shell casting of Brillion Iron Works, Brillion, Wis., with Plenco #47 resin.

The former dry sand method required 114 pounds of molding material for two castings. The shell mold process requires only 38 pounds of molding material for four castings. Casting weight itself was reduced by one pound over the dry-sand cast part as less machining stock was necessary. Substantial savings were thus effected by Brillion in labor, time and materials. Here is another example of how a foundry, by splendid engineering, made use of the shell molding process in improving a product at lower cost.

Such savings are but a few of the many advantages offered by Plenco phenolic resins. Consult with us on your shell molding problems and the application of our various Plenco resins, solid and liquid, and also adhesives for this process.

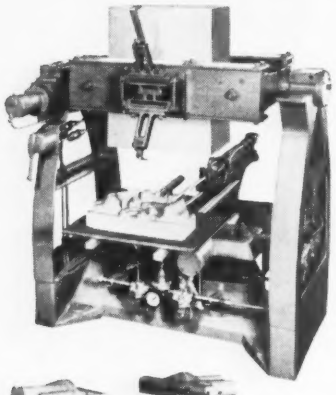
PLENCO PHENOLICS
FOR BETTER PLASTIC PRODUCTS

PLASTICS ENGINEERING COMPANY
Sheboygan, Wisconsin
Serving the plastics industry in the manufacture of high grade phenolic molding compounds, industrial resins and coating resins.

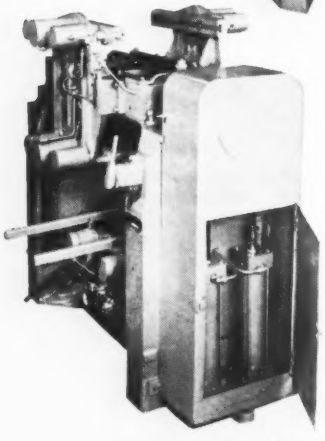
BOOST CORE OUTPUT UP TO 400%

...stabilize quality, too!

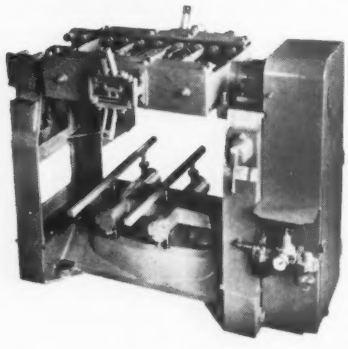
3 BASIC MODELS



Automatic Double Rollover Core Draw Machine. Shown with automatic pushout device (optional equipment), (Model No. SP-2020), which positions the drawn cores for easier removal. Pushout device and elevator mechanism available for all Sutter Core Draw Machines.



Automatic Double Rollover Core Draw Machine with side draw backs. Model SP-541. Cycle—approximately 20 seconds. Maximum Core box size 26″ long x 13″ wide x 10″ deep.



Automatic Double Rollover Machine for heavy duty operation. Operating cycle is 6 seconds minimum. Available in three standard sizes.

SUTTER

CORE DRAW MACHINES

Because they provide completely automatic cycle, Sutter Core Draw Machines boost production from 300% to 400% and provide absolutely uniform high quality since the human element is entirely removed from the draw operation.

All the operator need do is to place the core dryer and, while the cycle continues automatically, remove the core drawn from the previous cycle. The dryer is clamped, the box rolled over and the core is drawn without any attention from the operator.

Because of the simplicity of operation, peak production can be maintained easily by unskilled operators. When used in conjunction with a blower, the operator can perform both the blow and draw operations with ease.

In addition to three standard models, each in a variety of sizes, Sutter also designs and builds special units to suit unusual needs. Our engineers will be delighted to discuss your operations and point up the savings these versatile machines will provide to you. Just write or wire today for technical bulletins.

SUTTER

SUTTER PRODUCTS CO.

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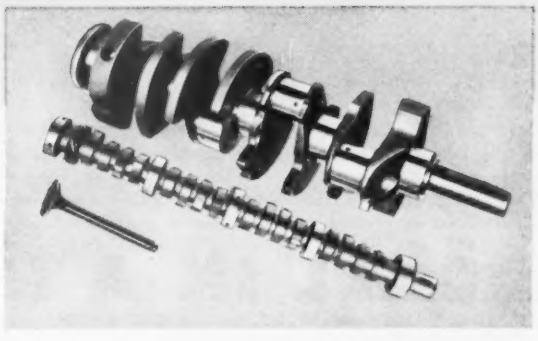
SHELL RESINS...
used extensively at FORD



Parts by the million for '56 Fords are

PRECISION-MOLDED with G-E SHELL RESINS

Ford Motor Company, one of the country's biggest precision molders, uses shell resins for precision-molded crankshafts, camshafts, exhaust valves.

Why did Ford turn to precision molding? Because of the advantages this method offers over conventional sand-casting: greater dimensional accuracy, smoother surface finish, drastic reductions in machining! And the Ford foundry uses G-E shell resins for fast-curing, dimensionally stable shells necessary for high-volume production.

How can shell molding help YOU?

General Electric offers a number of foundry products to help *you* get maximum benefits from the new process: *G-E phenolic shell-molding resins* to form light, dimensionally accurate molds . . . *G-E silicone parting agents* to secure quick, easy release of molds from patterns . . . *G-E phenolic bonding resin* to cement shell halves together.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Ask G. E. about shell molding!

General Electric maintains a shell-molding laboratory in Pittsfield, Mass., to help users and prospective users of shell molding solve problems and evaluate the process for their own needs. G.E. also offers an informative 28-page manual describing the techniques and benefits of this new foundry method. *Just mail the coupon for a free copy!*

FREE SHELL MOLDING MANUAL!

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Chemical and Metallurgical Division
Pittsfield, Massachusetts

Please send me a free copy of *G-E Shell Molding Manual.*

( ) We are presently using the shell-molding process.
( ) We are interested in the shell-molding process.

Name_____

Firm_____

Street_____

City_____ Zone____ State_____

When you need expert foundry advice ask the man who

CALL IN A REPUBLIC PIG IRON

His thorough knowledge of foundry operations is based upon a combination of metallurgical training and years of actual foundry experience. He knows all types of pig irons and their characteristics. He knows what they will do or will not do under certain conditions. He keeps up to the minute on all the latest foundry techniques.

The Republic Pig Iron Metallurgist is a welcome visitor in hundreds of foundries. They rely on him for advice on pouring problems, molding practice, improving efficiency. Or for help on reducing costs, improving castings and increasing output.

Republic is the only producer of a complete line of merchant pig irons. Therefore,

REPUBLIC

REPUBLIC STEEL

World's Widest Range of Standard Steels

knows his irons—

METALLURGIST

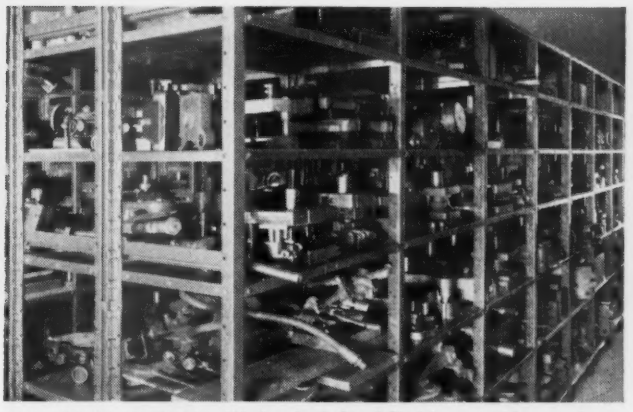
the Republic Pig Iron Metallurgist is able to recommend the proper grade of pig iron for a specific job without hesitation or prejudice.

If you have a foundry problem, ask the man who knows his irons—call in a Republic Pig Iron Metallurgist. His service is confidential and without obligation. Mail the coupon for prompt action.

STEEL

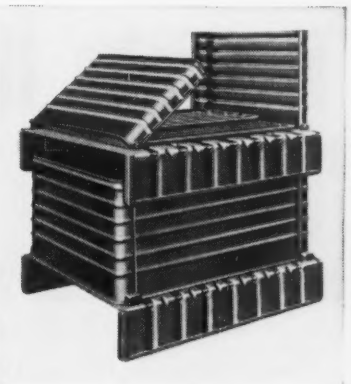
and Steel Products

FOR HANDLING CASTINGS—Republic Chain Slings provide an exceptionally high degree of safety. Made by Republic's Chain Division, they are available in Alloy Steel, High Test Steel, and Wrought Iron. All are proof tested and warranted to meet or exceed specifications. Each type has a specific use. A Republic Chain Engineer will tell you promptly which chain sling is best suited to your particular requirement.



FOR STORING CASTINGS—Wedge-Lock Steel Shelving provides maximum loading in minimum floor space. It's specifically designed for high stacking of enormous weights—with no sagging, no swaying, no buckling. Joints actually get tighter as weight increases. Wedge-Lock Steel Shelving is completely flexible to meet changing needs. It can be assembled quickly and easily. A product of Republic's Berger Division.

FOR SHIPPING CASTINGS—Republic's Pressed Steel Division makes the PB-127 Collapsible Box. It's designed for *heavy-duty service*. It can be tiered when loaded or empty—collapsed or set up. All parts are permanently attached. The PB-127 unit solves the problem of storing and shipping empty boxes and can save you up to 66% of your storage space. Republic Materials Handling Specialists will help you design units to meet your specific needs.



REPUBLIC STEEL CORPORATION
3132 East 45th Street, Cleveland 27, Ohio

☐ Please have a Pig Iron Metallurgist call.
I am interested in more information on:
☐ Republic Sling Chains ☐ Republic Collapsible Boxes
☐ Wedge-Lock Shelving

Name_____ Title_____
Company_____
Address_____
City_____ Zone____ State_____

K-9669

BF—A universal favorite for deburring, lighter finishing, cleaning slots in castings, spot grinding cast surfaces for inspection, and many other light portable and bench grinding applications. For periphery grinding only.

The jobs they do!...The money they save!

Norton Reinforced Wheels add the "TOUCH of GOLD" that cuts time and costs on countless foundry grinding jobs

You get *more* than 100 cents' worth of usefulness for every dollar you spend on Norton Reinforced Wheels.

You get extra-long service life, exceptional strength and fast, cool, trouble-free grinding — the Norton-engineered "Touch of Gold" that saves you money in the widest range of cleaning room jobs, from light deburring to heavy cutting-off.

To this top grinding performance Norton Reinforced Wheels add a wide margin of safety. All four are resinoid bonded and reinforced by layers of tough fabric molded into them. As follows:

BF — *Semi-flexible straight wheel, cotton fabric reinforcement. Also available in mounted wheels and points and hand sticks.*

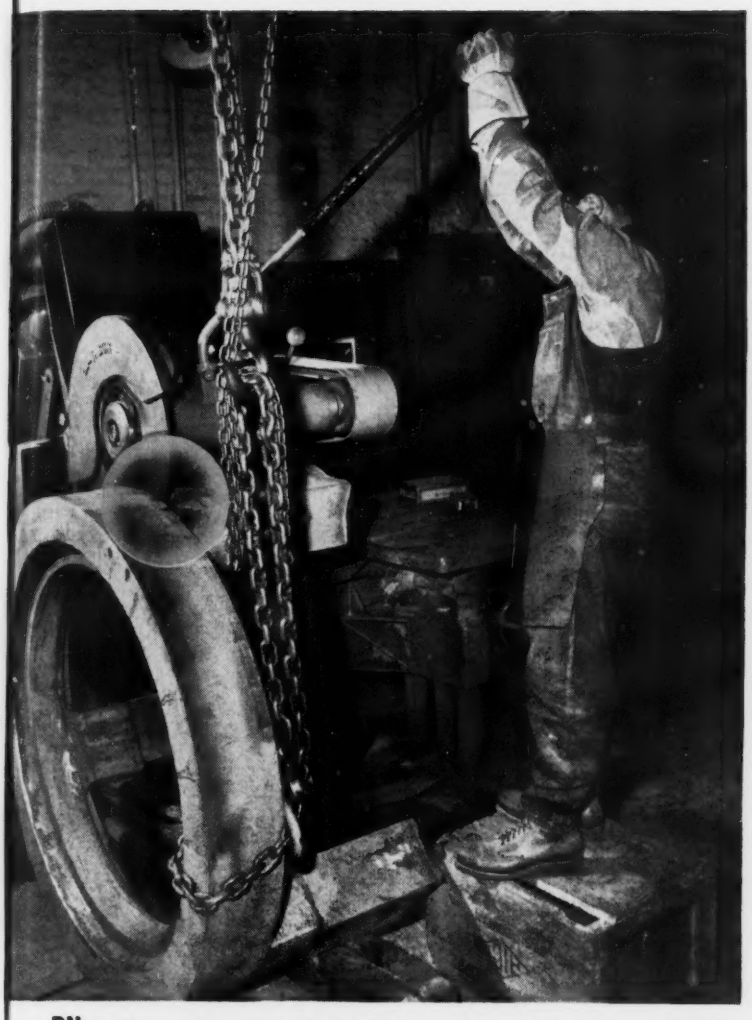
BN— *Straight wheel with glass cloth reinforcement. Primarily a cut-off wheel, its rough, knurled sides provide additional cutting action.*

BD—*Rigid hub-type. Glass cloth and Nylon reinforcement for extra hub-wheel safety. Designed especially for right angle portables and disc sanders.*

BFR—*Semi-flexible hub-type. Cotton fabric and Nylon reinforcement.*

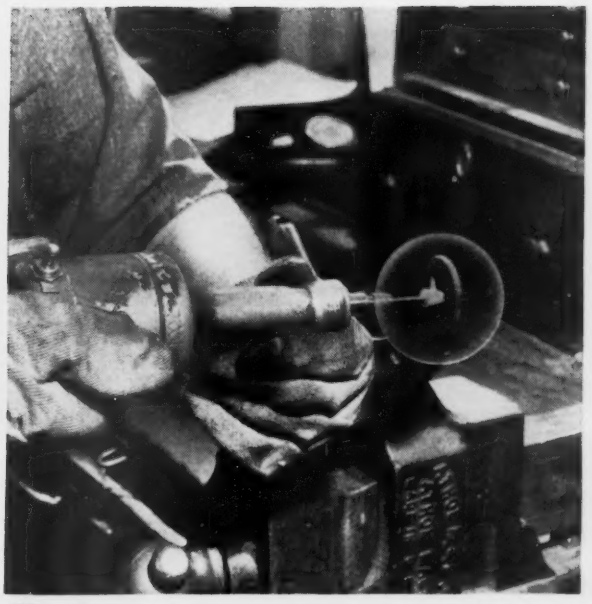
See Your Norton Distributor

for a demonstration of Norton Reinforced Wheels in your foundry, on the jobs you're doing every day. Ask him for the new, 34-page illustrated catalog on reinforced wheels. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your phone book, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.



BN — The preferred cut-off wheel for non-ferrous jobs. Also excellent for deburring, slotting, cleaning and light snagging. Used on all types of heavy and light duty foundry cut-off machines.

BFR — Excels at the lighter portable jobs, such as removing rust and scale, light finishing, notching or cutting-off gates and risers. Reaches hard-to-get-at places.



BF — **Mounted Wheels and Points** have the same strong laminated construction as the larger BF wheels. For cleaning die cavities, chamfering, Brinell spotting, etc. For hand finishing, use BF sticks.

BD — A specialist in heavier stock removal jobs on all metals, such as cleaning between teeth of large gear castings, removing heavy scale, notching large gates and risers. Also for slotting and cutting-off.

W-1642

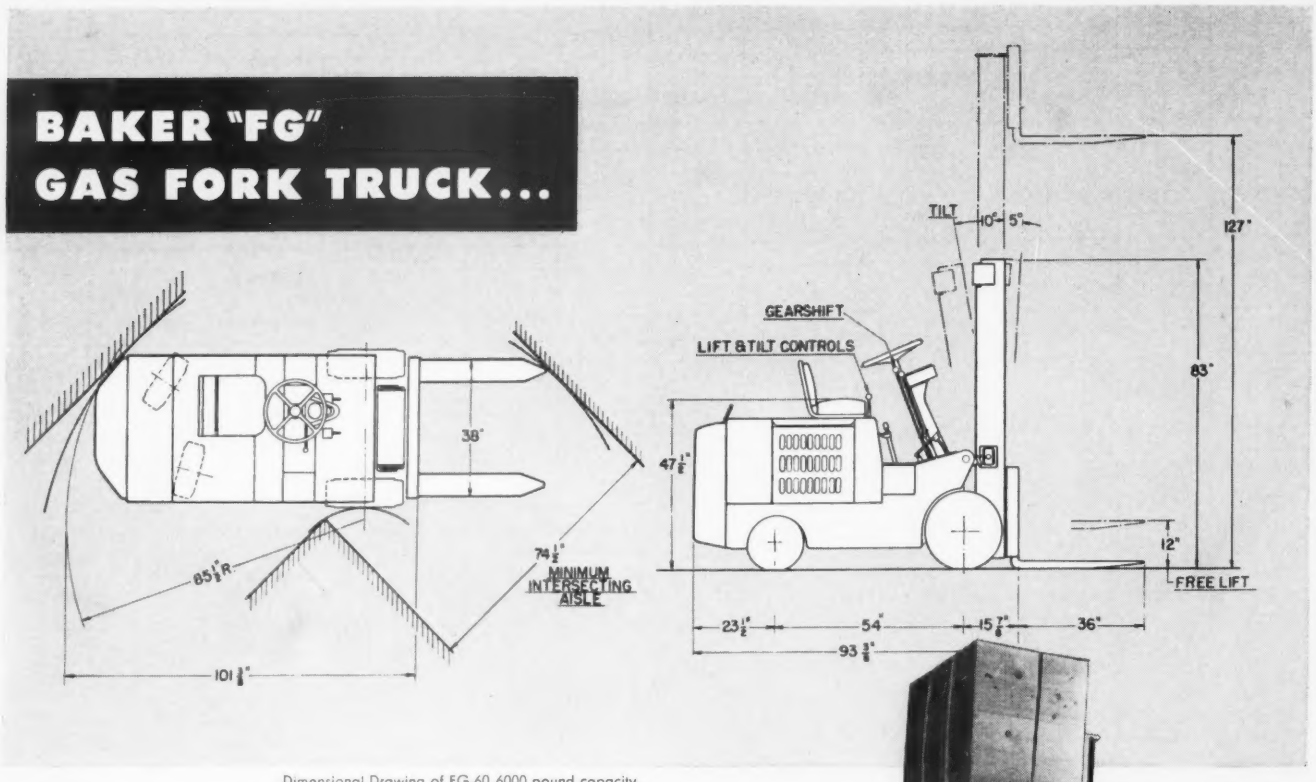
NORTON

Making better products... to make your products better

and its BEHR-MANNING division

NORTON COMPANY: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

BAKER "FG" GAS FORK TRUCK...



Dimensional Drawing of FG-60, 6000 pound capacity.

why "BALANCED DESIGN" makes it the best!

"Balanced Design" means that every component be engineered to its specific function. Further that all elements be matched and coordinated to work together for top efficiency, maximum dependable service and longest life.

In the "Balanced Design" Baker FG Gas Trucks, for example, you get an integrated power train, consisting of drive axle, transmission and clutch, selected and engineered to be the best possible unit to perform its required function. Features include: compact rigid construction without troublesome universal joints, split clutch housing for easy accessibility, and *single oil supply for entire assembly.*

"Balanced Design" also assures you that the power plant is not merely an automotive engine modified for truck use. It is a heavy-duty industrial engine specially engineered for rugged industrial truck service and built by an outstanding manufacturer. Our specifications call for moving parts to balance much closer than ordinary engine parts: pistons balanced to ± grams instead of ounces, crankshaft to 4 inch-ounces and connecting rods to 2 grams.

These are some of the reasons why Baker "FG" is the only gas fork truck with a full 6 months' warranty, and why we say "BALANCED DESIGN" makes it the best.

Baker "FG" gas fork trucks are available with 3,000, 4,000, 5,000 and 6,000 pound capacities. Specific bulletins can be obtained by writing The Baker-Raulang Co., 1223 West 80th Street, Cleveland 2, Ohio.

A Subsidiary of Otis Elevator Co.

Baker®
handling equipment

8 REASONS WHY THE BAKER FG FORK TRUCK IS FIRST IN ITS CLASS...

1. LOWER INITIAL COST—Costs considerably less than other trucks in its class.

2. LONGER WARRANTY PERIOD—Baker quality permits full 6 months warranty.

3. HIGHER LIFT—Mast design allows higher standard lift than ordinary trucks.

4. LOWER MAINTENANCE COSTS—Designed for easier and less frequent servicing.

5. MORE MANEUVERABLE—Short turning radius cuts aisle width, adds floor space.

6. EASIER TO OPERATE—Greater visibility . . . easy-to-work controls.

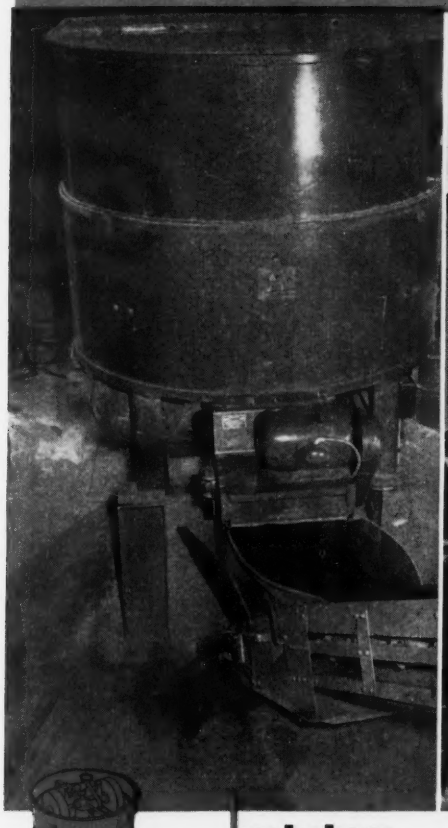
7. GREATER STABILITY—Lower center of gravity, higher "stability factor" ratio.

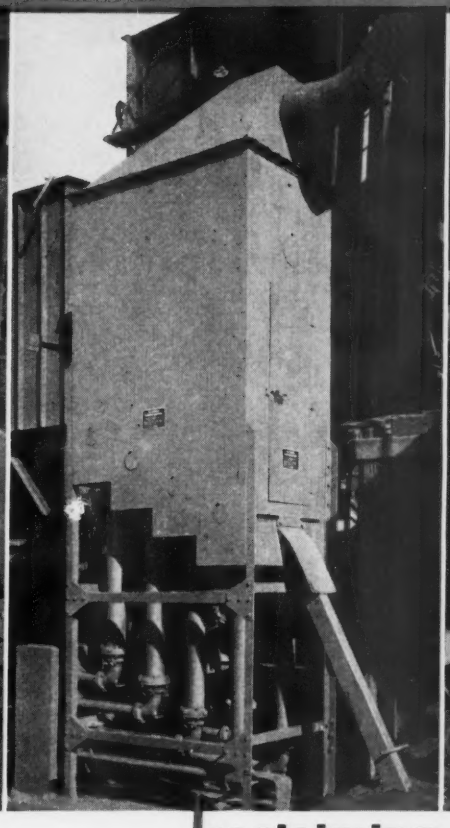
8. GREATER BRAKING—Full floating, self-equalizing, self-energizing brakes.

5G5

NATIONAL

Means Equipment and Service for BETTER Sand Practice





mixing | **reclaiming** | **handling**

SIMPSON MIX-MULLERS
25 to 4000 lb. batch capacity

NATIONAL SAND RECOVERY SYSTEM
Practical pneumatic sand scrubber

NATIONAL HYDRO-FILTER
Wet-type dust collector

SIMPSON PORTO-MULLER
250 lb. capacity (100% portable)

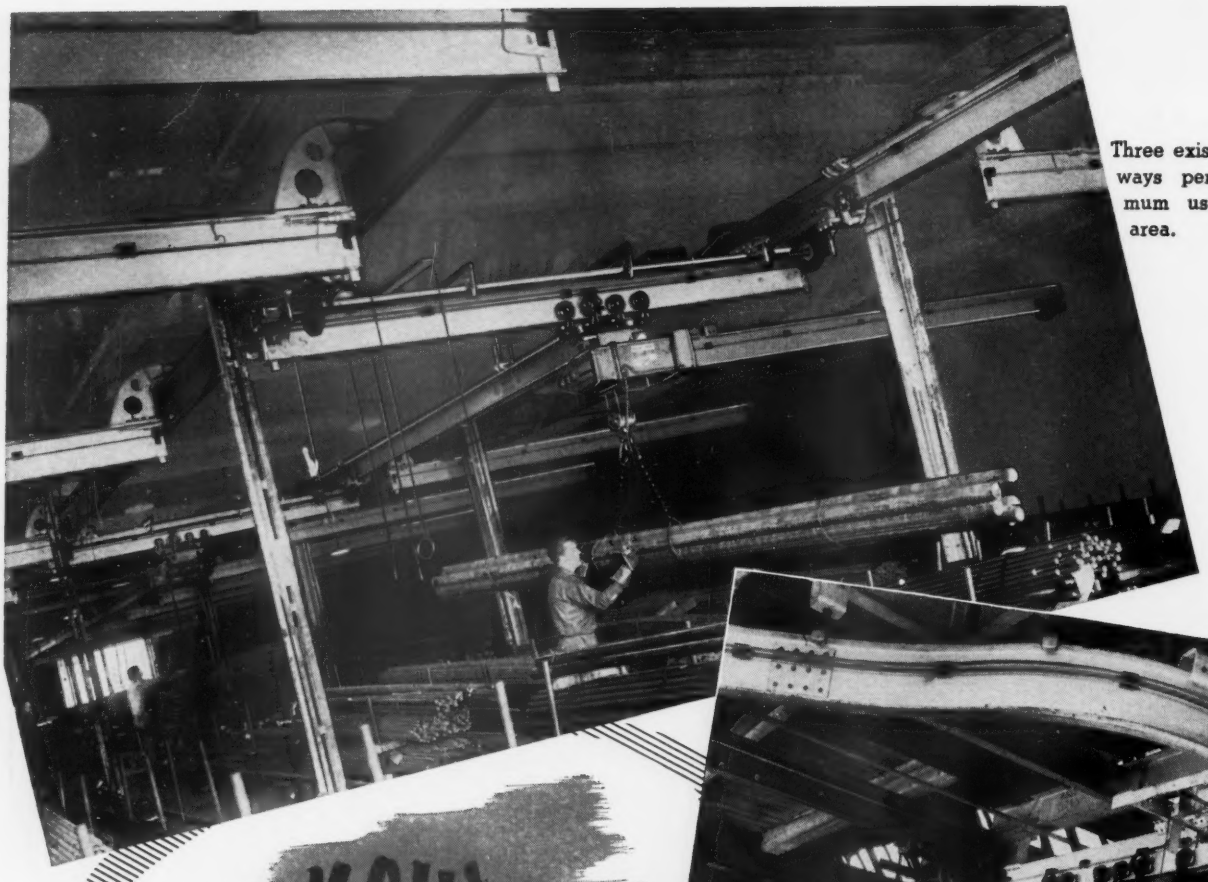
Just as the process of mulling has made possible the use and benefits of synthetic molding sand, so have the efforts of National Engineering Company been continued toward the development of products and practices that help you make better *use* of sand:

- Today's Simpson Mix-Muller has been improved to provide infinite control over muller pressures. Maximum pressures are automatically developed as the sand increases in strength towards the end of the cycle.
- The National Pneumatic Sand Recovery System has made the dry recovery of "burnt out" sand practical — and within the economic and physical reach of most foundries.
- The services of your National Engineer have been broadened through the years to offer practical, experienced assistance in every phase of sand handling, molding and casting practice.
- A subsidiary company, National Dust Collector Corporation, now offers a wet type dust collector that can cite efficiencies of 98.2 to 99.1% in collecting foundry shakeout dust.

These are but a few of the reasons why when you *buy National* you buy products of the practical foundrymen . . . made for the foundry, *by* foundrymen.

If your problem is in sand preparing, sand handling, mold handling or excessive waste sand — call your National engineer today.

National Engineering Company
(Not Inc.)
646 Machinery Hall Bldg. • Chicago 6, Illinois



Three existing craneways permit maximum use of floor area.

new MONORAIL ties into old... for flexible system

New MonoRail section of versatile up-and-over system.

A newly engineered section was added to three existing MonoRail craneways in this bar stock warehouse. As a result, incoming material can be picked up from a car and transported on this highly efficient overhead system to storage area. When the raw stock is needed, this up-and-over system has it there on schedule. If you have a materials handling problem, call your nearby American MonoRail engineer. He is qualified to help you answer it.

Member of Materials Handling Institute - MonoRail Association

Photos courtesy of Super Steels, Inc., Chicago, Ill.

AMERICAN OVERHEAD HANDLING EQUIPMENT

MONORAIL COMPANY

13104 ATHENS AVENUE
CLEVELAND 7, OHIO

Late News

SCRAP SQUABBLE: Recent sharp increases in iron and steel scrap prices are prodding consumers to renew their protests against record-breaking exports. Foreign shipments for 1955 will be close to 5 million net tons. At the same time demands of steel mills and foundries were at a high rate. And individual companies and foundry trade associations maintain that the heavy exports have triggered much of the latest rise in domestic prices.

Steelmaking grades have moved up the fastest—to an all-time high. Iron scrap prices have risen about 25 per cent since a year ago but are well below the dizzy heights reached in 1948. The market recently has been so volatile that published prices rapidly have become obsolete. In some grades quoted prices mean little because of the limited supply available.

Operating costs of iron foundries also have been hit lately by price advances in coke and silvery pig iron.

ALUMINUM AT PEAK: Production of primary aluminum set a new record in 1955 for the fourth year in succession. Output topped 1,500,000 tons, about 7 per cent ahead of 1954. Despite heavy production, supplies remained tight throughout 1955. Some relief came through the government's diversion of stockpile metal to industry. The Office of Defense Mobilization has announced that no aluminum will go to the stockpile in the first and second quarters of 1956.

SMELTER EXPANSION: Apex Smelting Co., Chicago, smelter and alloyer of aluminum, has started construction of an addition to its California plant which will double its capacity and provide space for future increases when needed. The original plant started operations in May, 1953. Dwight L. Palmer, vice president, is plant manager. Apex also operates smelting plants in Chicago and Cleveland.

FOUNDRY STAFF CHANGES: C. H. Walcher, works manager, Granite City (Ill.) Works, American Steel Foundries, has been transferred to the staff of the vice president-manufacturing, Transportation Equipment Division, as consultant. He will remain at Granite City. R. O. Tibbals, formerly assistant works manager, has been moved up to works manager.

MOLY PRICE UP: Climax Molybdenum Co., New York, has increased prices of molybdenum products an average of about 5 per cent, effective Dec. 15. The increase in most sizes of ferromolybdenum is 8 cents per pound of contained molybdenum. This brings the total increase in molybdenum prices since 1950 to about 10 per cent.

BRITISH FOUNDRIES BUSIER: Production of gray iron and malleable iron castings in Great Britain during the third quarter increased to a total of 883,620 tons. This was 3.5 per cent higher than a year ago. Output for the first nine months of 2,897,760 tons was nearly 6 per cent ahead of the 1954 period. By contrast, shipments of iron castings in the United States during the first three quarters increased 29 per cent compared with 1954.

FOUNDRY TRAINING: A study of training in mechanized foundries will be conducted during January by the U. S. Department of Labor. It is the first phase of a broad program to assist the foundry industry in solving manpower and training problems resulting from technological developments. The 40 foundries to be included in the study were selected by an industry committee which is co-operating with the Department of Labor in this work. Fred G. Sefing, International Nickel Co., is temporary chairman of the foundry committee.

PERSONALS: R. Grant Whitehead, recently assistant to the sales manager, Claude B. Schneible Co., Detroit, has been appointed sales manager . . . Edward R. Couch has been appointed manager of stationary compressor sales for the Le Roi Division, Westinghouse Air Brake Co., Milwaukee . . . Michael Gladstone, former president of Centrifi-Cast Co., New York, has been made sales manager, Alloy Precision Castings Co., Cleveland; Edward J.

Vargo is new chief metallurgist and C. B. Beener chief engineer . . . Superior Steel & Malleable Castings Co., Benton Harbor, Mich., has appointed Alan R. Moore as engineer in the product development laboratory, Paul R. Hennum as personnel manager and J. K. Hutchens as special product salesman . . . Frank Van Boxel is retiring in January as assistant to the sand foundry manager, Aluminum Co. of America, Cleveland . . . Arthur P. Guidi has joined Texas Foundries Inc., Lufkin, Tex., as assistant to the plant manager, and Peter D. Humont has been appointed sand supervisor.

INVESTMENT SPURT: Orders for investment castings in recent months have been 40 to 50 per cent heavier than a year ago, and 1956 sales may total $175 million. This is the prediction of Vincent S. Lazzara, president, Investment Casting Institute, and president of Casting Engineers Inc., Chicago. Sales in 1948 totaled $75 million. The institute reports that 70 per cent of the industry's members have been making investment castings for only ten years or less. While aircraft components remain the backbone of the industry's business, new applications in numerous other fields are reported to be expanding rapidly.

OBITUARY: James McElgin, 54, manager of the metalworking department of E. F. Houghton & Co., Philadelphia, died in Chicago Dec. 7 . . . James J. Trant, 79, retired superintendent of foundries, Pullman Standard Mfg. Co., Chicago, died there Dec. 10 . . . Walter E. Oelschlaeger, 67, manager, by-product division, Republic Coal & Coke Co., Chicago, died there Nov. 28.

MISCELLANY: Bucyrus-Erie Co., Milwaukee, marked its 75th anniversary Dec. 8 . . . Misco Precision Casting Co., Whitehall, Mich., is building a new plant in Muskegon, Mich., to contain 85,000 square feet of office and manufacturing space . . . October sales index of the Foundry Equipment Manufacturers Association was 108.6, against 156.7 in September and 147.5 in October, 1954 . . . Southington Foundry Co. Inc., Southington, Conn., jobbing producer of gray iron and nonferrous castings, is doubling its plant capacity.

Prices of Foundry Metals and Coke

(As of December 22, 1955)

FOUNDRY COKE

(Per net ton, f.o.b. ovens)

BEEHIVE	
Connellsville	$16.00-17.00
OVEN	
Birmingham	$24.40
Buffalo	27.50
Chicago	27.00
Detroit	27.50
Erie, Pa.	27.50
Indianapolis	26.75
Kearny, N. J.	26.75
Lone Star, Tex.	19.50
Milwaukee	27.50
Montreal, Que.	27.25
Neville Island (Pittsburgh)	26.25
New England, deld.	28.55
Painesville, O.	27.50
Philadelphia	26.50
St. Paul	26.50
Swedeland, Pa.	26.50
Terre Haute, Ind.	26.75

PIG IRON

(Per gross ton f.o.b. furnace)

	No. 2 Foundry	Malleable
Bethlehem, Pa.	$61.00	$61.50
Birmingham	55.00	....
Buffalo	59.00	59.50
Chicago	59.00	59.00
Cleveland	59.00	59.00
Duluth	59.00	59.00
Erie, Pa.	59.00	59.00
Everett, Mass.	65.00	63.00
Fontana, Calif.	62.50	....
Geneva, Utah	59.00	....
Granite City, Ill.	60.90	61.40
Lone Star, Tex	55.00	....
Neville Island (Pittsburgh)	59.00	59.00
Steelton, Pa.	61.00	61.50
Swedeland, Pa.	61.00	61.50
Toledo, O.	59.00	59.00
Troy, N. Y.	61.00	61.50
Youngstown, O.	....	59.00

NONFERROUS INGOT

(Cents per pound, carlots)

BRASS AND BRONZE: Red brass, No. 115, 42.00; tin bronze, No. 225, 56.00; No. 245, 48.75; high-leaded tin bronze, No. 305, 45.75; No. 1 yellow, No. 405, 33.25; manganese bronze, No. 421, 37.75.

ALUMINUM: 99 per cent plus primary ingots 24.40. Secondary No. 12 alloy 31.75-32.00. Deoxidizing grades: No. 1, 31.50-32.75; No. 4, 29.25-30.50.

MAGNESIUM: 99.8 per cent notched ingots 33.25, f.o.b. Freeport, Tex. (10,000 lb or more).

COPPER: Electrolytic 43.00 delivered Connecticut valley.

ZINC: High grade 14.35 delivered. Die casting alloy no. 3, 17.50 delivered.

IRON AND STEEL SCRAP

(Consumer prices per gross ton delivered, except as otherwise noted)

	No. 1 Heavy Melting Steel	No. 1 Cupola Cast	Heavy Breakable Cast	Clean Auto Cast	Machinery Cast	Malleable	Short Steel Rails
Birmingham	$43.00-44.00	**$47.50-48.00	.....	.....	.....	.....	$63.00-65.00
Boston*	**43.00-44.00	**37.00-38.00	.....	.....	**40.00-41.00	.....	.....
Buffalo	45.00-46.00	**40.00-41.00	.....	.....	**43.00-44.00	.....	57.00-58.00
Chicago	48.00-51.00	50.00-51.00	.....	55.00-56.00	55.00-56.00	61.00-62.00	67.00-69.00
Cincinnati*	**45.00-46.00	**46.00-47.00	**44.00-45.00	.....	**54.50-55.50	.....	**67.00-68.00
Cleveland	51.00-52.00	54.00-55.00	41.00-42.00	52.00-53.00	54.00-55.00	59.00-60.00	71.00-73.00
Detroit*	**46.00	**45.00	**35.00	**46.00	.....	**40.00	.....
Los Angeles	39.00	**43.00-45.00	.....	.....	.....	.....	.....
New York*	47.00-48.00	47.00-48.00	45.00-46.00	.....	.....	.....	.....
Philadelphia	52.00	50.50	52.00-53.00	.....	57.00	66.00	.....
Pittsburgh	50.00-51.00	45.00-46.00	44.00-45.00	.....	54.00-55.00	.....	67.00-69.00
St. Louis*	41.50	47.00	40.00	47.00	.....	.....	65.50
San Francisco	42.00	50.00	36.00	50.00	50.00	.....	.....
Seattle	44.00	**50.00	**38.00	**40.00	.....	.....	.....

*Brokers' buying prices. **F.o.b. shipping point

For Cleaner Surfaces, Better Shakeout, Try WHITEHEAD'S NEW LYQUAFLOUR

Our new plant has just been completed at Irwin, Penna., to produce the new DOUBLE-STRENGTH LYQUAFLOUR. This compound of a special hydrocarbon and woodflour improves castings and mold conditions for all types of metals. Highly recommended for the advantages listed below:

- One sand additive controls both peel and expansion
- Good shakeout saves sand
- Imparts highest flowability to sand mixture to give pattern true finish
- 2% initial treatment of sand and as little as ¼ of 1% to reactivate does the job
- Replaces any carbon or hydrocarbon materials now used
- Eliminates dust at the muller
- Castings peel excellently which reduces cleaning room time
- Reduces penetration and burn-on
- Overcomes sand expansion defects, maintains good compression strength
- Improves molding, "feel", and "moldability"
- No rigid control required
- Permits hard ramming
- Less ramming required, more molds per hour
- Less temper water needed

Whitehead Brothers COMPANY

Established 1841

NEW YORK OFFICE
324 West 23rd St., New York 11, N. Y.

NEW ENGLAND OFFICE
17 Exchange Place, Providence, R. I.

Manufacturers of

LYQUAGRIP
Ready-to-use core paste

JOINT SEAL
Plastic compound for perfect sealing

LYQUAFACE
The liquid sand grain coating

DOB-IT
Ready-to-use core mudding compound

Another new development using

B. F. Goodrich Chemical *raw materials*

Casting costs cut by new liquid acrylic core binder

Good-rite®

CB-35

GOOD-RITE CB-35 is an entirely new core binder—a liquid, acrylic material. It has proved in actual foundry operation to be versatile, cost-saving, and superior. Check these points—

FAST BAKING—no curing or chemical action

NEGLIGIBLE GAS formation—cereals not necessary

EXCELLENT COLLAPSIBILITY and shake-out—shake-out costs reduced up to 50%

TOLERANCE FOR OVER BAKING—maximum physical properties over wide temperature and time ranges

A technical representative will be glad to work with you to show you how this new material improves operations and cuts costs. Please write Dept. R-1, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

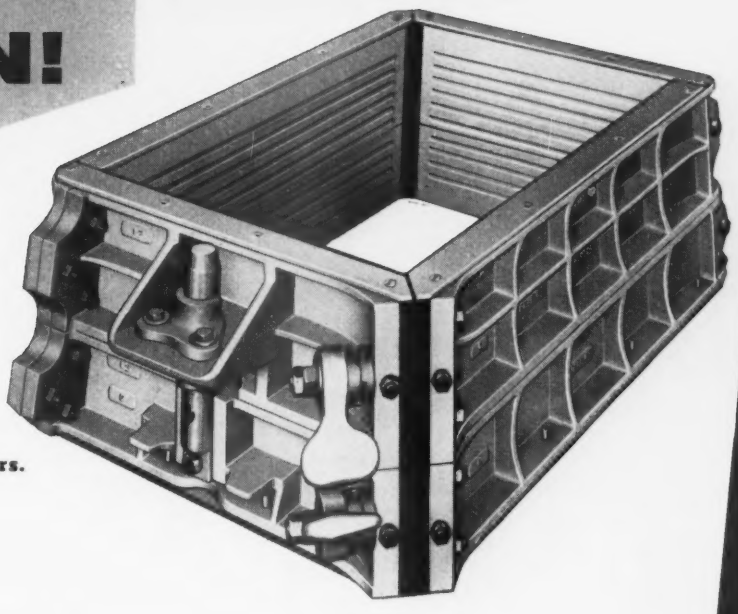
Good-rite CHEMICALS

B. F. Goodrich Chemical Company

A Division of The B. F. Goodrich Company

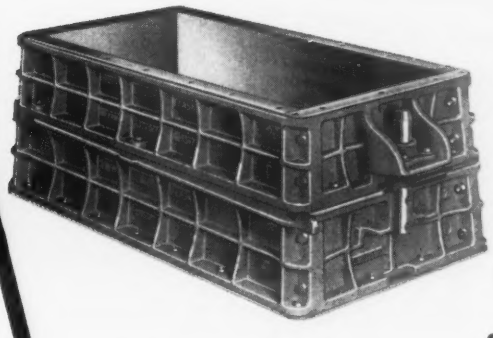
GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors

Performance PROVEN!



Fremont magnesium Spreadlock Flasks by actual use have been proved easier to handle . . . much sturdier than aluminum. They take abuse . . . last longer.

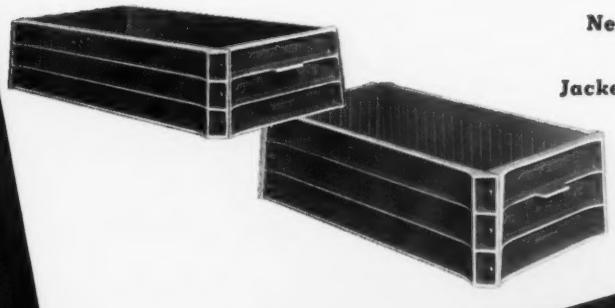
Accurately machined, they assure more exacting work. The men like them. No sand can lodge in the corners. Gaps are completely closed by long-life, replaceable live rubber inserts.



GUARANTEED PERFECT ALIGNMENT

The foolproof GROOVLOCK pin on Fremont Standard Slip Flasks is the difference.

SAVE IMPORTANT MONEY

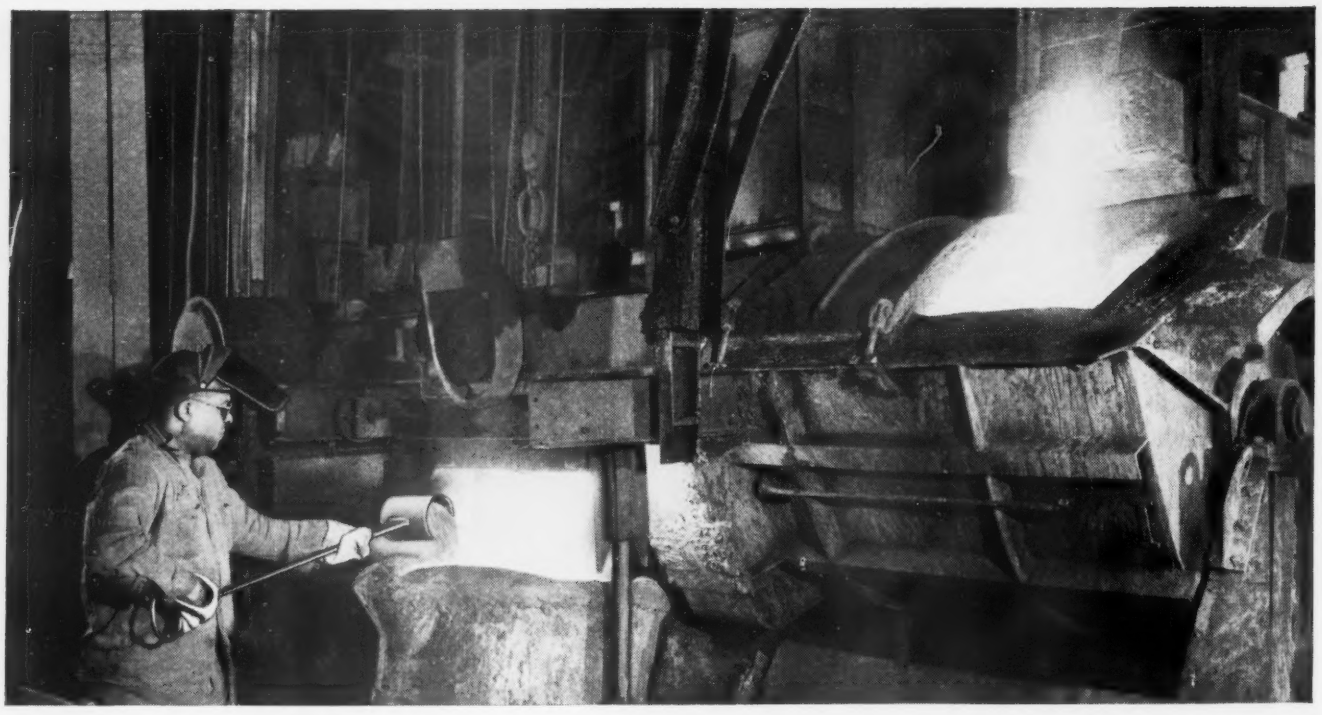


New sides or ends can be quickly inserted in Fremont Cast Iron or Cast Aluminum Jackets. Entire jackets need never be scrapped.

Write today for free literature and prices. All orders given prompt attention.

The Fremont FLASK Co.

Fremont, Ohio



ELECTROMET Supplies the Iron Foundry with Alloys for all Purposes

ELECTROMET offers you ladle or cupola addition agents for any of your foundry needs. Additions of ferro-alloys will adjust the composition of the base iron to make it suitable for the particular work on hand. You can reduce chill in thin-sectioned castings or improve strength and machinability. You can, if desired, increase hardness and improve resistance to wear and heat—all through simple additions of alloys. There is a wide variety of ELECTROMET alloys from which to choose.

ELECTROMET not only has the alloys to meet your needs, but also furnishes technical assistance in their use. Please phone or write the ELECTROMET office nearest you for detailed information on these or other ELECTROMET products.

ALLOYS FOR LADLE ADDITIONS

Ferrosilicons (50%, 75%, 85%, and 90%) In grades and sizes suitable for all conditions in the iron foundry. Silicon reduces chill in thin-section gray iron castings.

"SMZ" Alloy — A strong, super-graphitizing alloy and chill reducer. Contains zirconium and manganese to enhance the inoculating properties.

Calcium-Silicon—Inoculant for reduction of chill and for developing high-tensile strength. Especially suited for use in low carbon-equivalent irons.

Zirconium Alloys (12 to 15% and 35 to 40%) Graphitizers for reducing chill, aiding machinability, and improving tensile properties.

Ferrochromium Alloys — Available in many grades for cast iron. All grades have rapid solubility. Widely used to improve the hardness, strength, and heat and wear resistance of cast iron.

Ferrovanadium — ELECTROMET foundry grade ferrovanadium has good solubility. Vanadium improves toughness.

FOR CUPOLA ADDITIONS

"EM" Briquets—For adding chromium, manganese, silicon or zirconium to cast iron. "EM" briquets are scientifically designed for maximum alloy recovery in cupola melting.

ELECTRO METALLURGICAL COMPANY

A Division of Union Carbide and Carbon Corporation

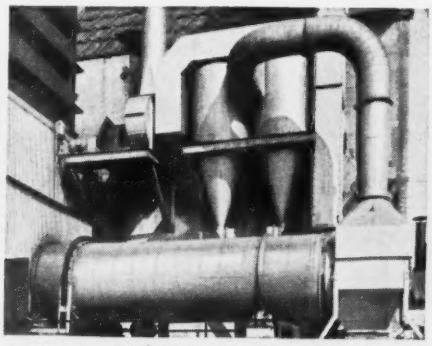
30 East 42nd Street UCC New York 17, N. Y.

OFFICES: Birmingham • Chicago • Cleveland • Detroit
Houston • Los Angeles • New York • Pittsburgh • San Francisco

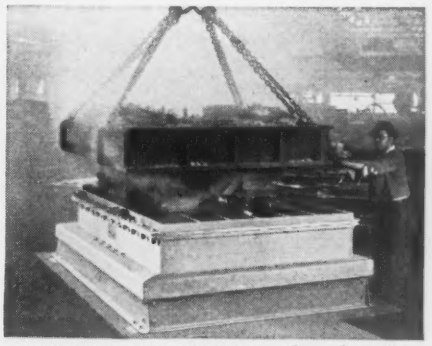
In Canada: Electro Metallurgical Company, Division of Union Carbide Canada Limited, Welland, Ontario

The terms "Electromet", "EM" and "SMZ" are registered trade-marks of Union Carbide and Carbon Corporation.

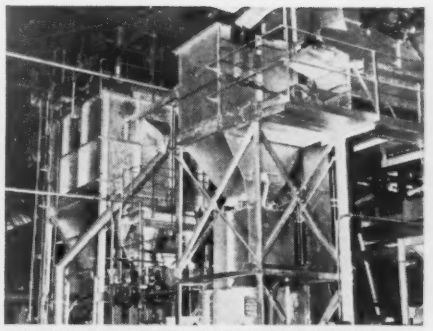
For handling sand and castings--



DRYERS — Link-Belt Roto-Louvre uniformly dries and cools large tonnages of sand. Floor space is conserved because no extra cooler is required.

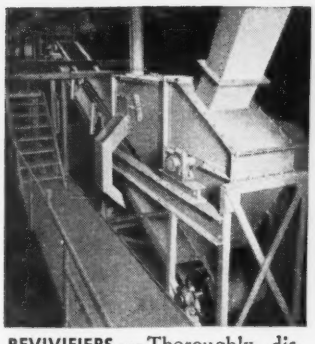


SHAKEOUTS AND SCREENS — Complete line provides centralized separation of sand and castings or sand screening for every type and size foundry.



BUCKET ELEVATORS, BINS AND HOPPERS — Low-cost elevating and storage of sand. Sturdily built in a wide range of types and sizes.

LINK-BELT quality equipment...



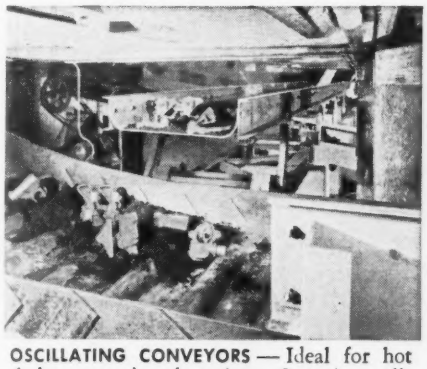
REVIVIFIERS — Thoroughly disintegrate, blend, cool molding sand so it will ram to uniform density. Also remove shot.

BELT CONVEYORS — Flat belt has plows to distribute sand to molders' hoppers. Troughed type used for other sand handling.

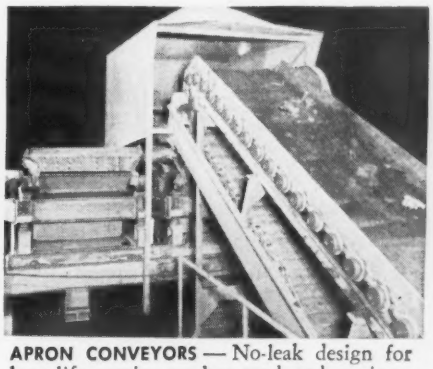
SHELL MOLDING SYSTEM for automatic, high-volume production of precision castings requiring little or no machining.

MOLD CONVEYORS — A full line of car, pallet, roller and trolley types meets all variations of foundry practice.

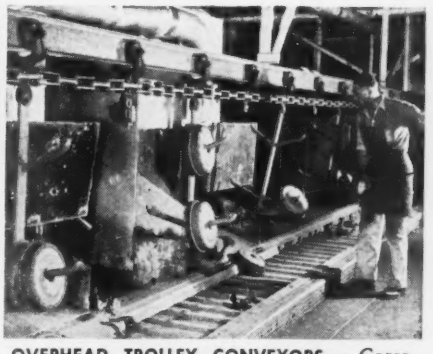
cuts your costs every step of the way



OSCILLATING CONVEYORS — Ideal for hot shakeout sand and castings. One-piece, all-metal trough eliminates wear, leakage. With screened trough section, acts as shakeout.

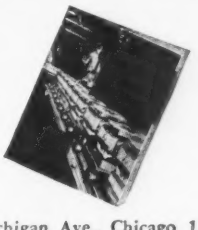


APRON CONVEYORS — No-leak design for long-life service on hot sand and castings. Operates in horizontal or steeply inclined paths. Also good as sorting conveyor.



OVERHEAD TROLLEY CONVEYORS — Cores, molds and castings are economically handled. Complete flexibility of path and capacity provided plus saving of floor space.

Ask your nearest Link-Belt office for new Book 2423. It shows Link-Belt's complete line of modern equipment for ferrous and non-ferrous foundries plus 7 tested layouts.



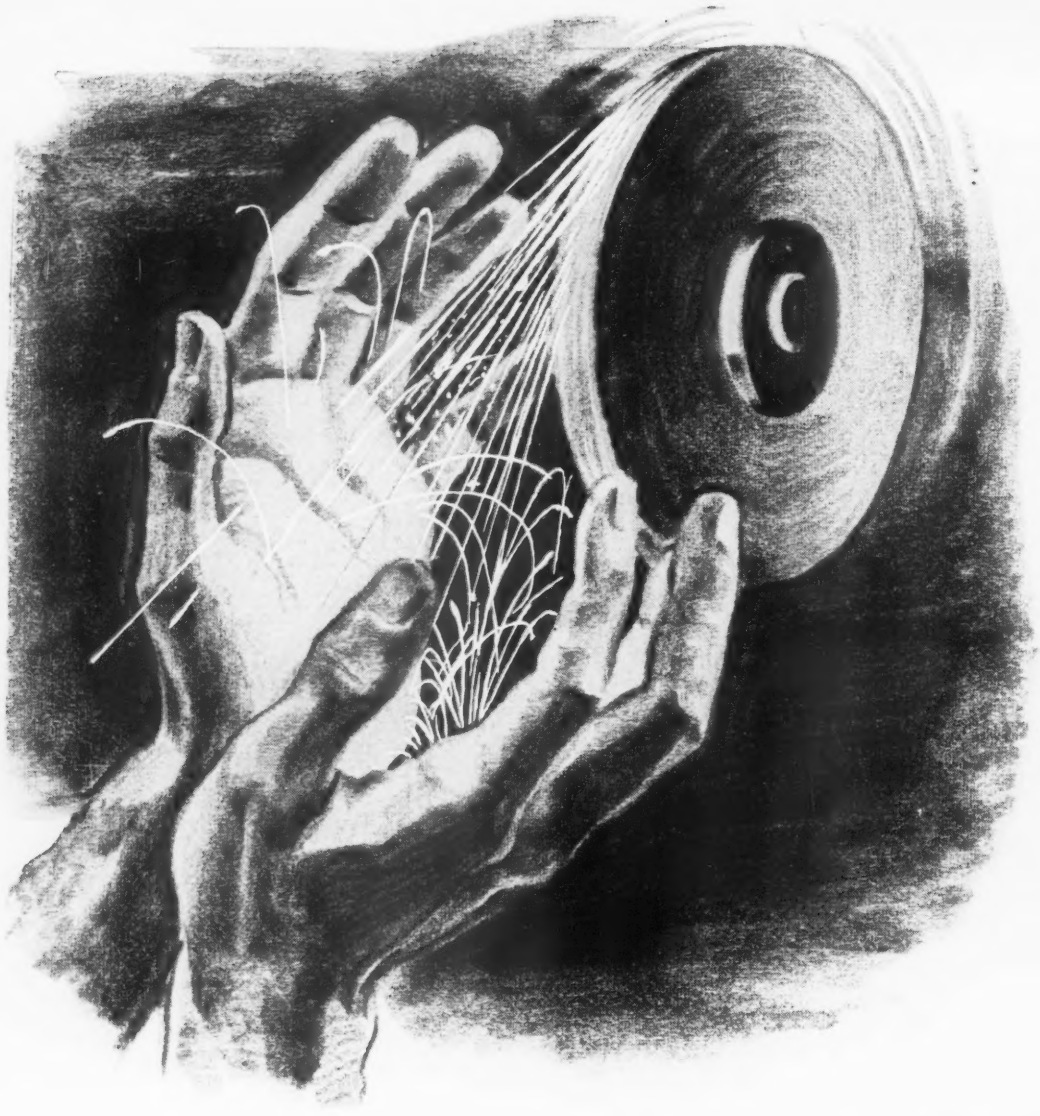
LINK-BELT

CONVEYORS AND PREPARATION MACHINERY

MEMBER FEMA

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

13,967



Taking the Grime out of Grinding

AS industry's most universally used piece of equipment, the grinding wheel is also one of its major dust sources. Almost a quarter century ago, AAF singled out this tool as a prime target for dust control.

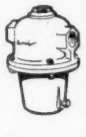
The goal—effective, low cost dust removal from the work area without restricting efficiency of the grinding operation. Today, thousands of grinders—bench, stand, portable, swing frame and high speed production units—are served by AAF Dust Control Equipment with lower maintenance costs, better employee and community relations as the inevitable results.

Over the years, AAF, through continued research and product development, has extended these benefits to practically every industrial dust producing operation. One of its sales engineers is located in your area—ready to place at your disposal the world's most complete line of dust control equipment backed by a success record unmatched in the industry. Call him today or write direct.

AAF herman nelson

American Air Filter
COMPANY, INC.
266 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

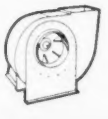
Herman Nelson Portable Heaters



Illinois Steam Heating Specialties

BETTER AIR IS OUR BUSINESS

AAF Electric Furnace Hoods



AAF Type K Exhauster

Stamina in Tough Service

B&W ALLMUL *with electrically fused grain for . . .*

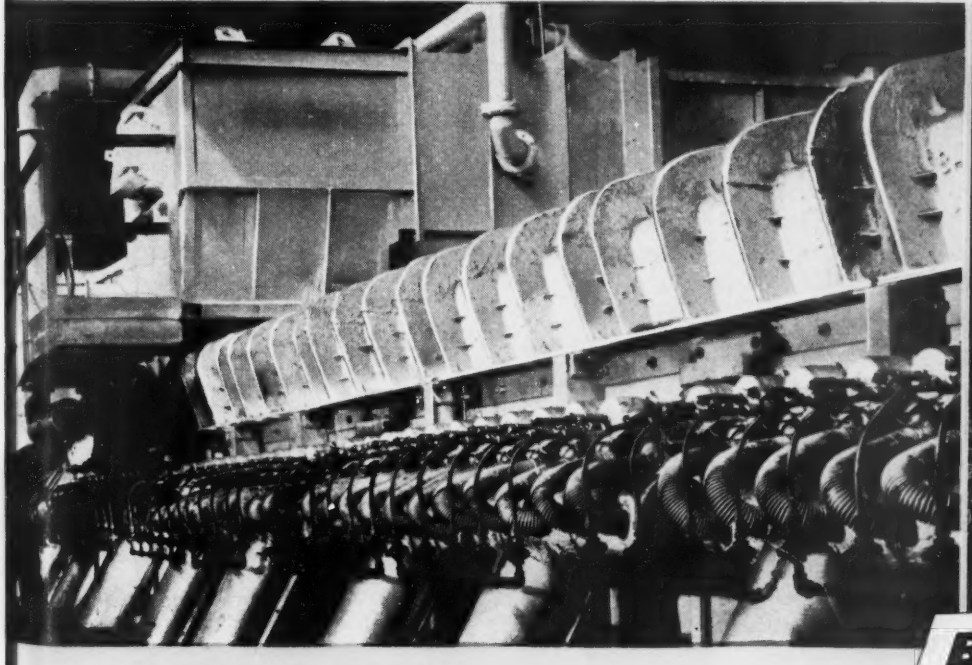
B&W Allmuls are used in many different kinds of heavy-duty furnaces. This example happens to be a butt weld furnace for continuous high speed welding of pipe. In the hottest areas (3000F or more), a mullite-*type* brick lasted only six weeks. Cause of failure: spalling, aggravated by metal penetration.

At the same locations, B&W Allmuls, made of electrically melted grain, lasted a full year—or more than eight times as long. It's by no means strange that the furnace operator now uses Allmuls for bungs, burner blocks, uptake arches and sidewalls, crossovers and furnace sidewalls.

Allmuls are volume produced by a highly efficient process. That's how you get—at relatively low first cost—top quality, fused-mullite brick with these properties: high hot load strength, high resistance to spalling, good volume stability, and a melting point of 3335F.

Whatever you're processing—steel or other metals, ceramics or chemicals—if your furnace demands a lining that can really take punishment, it will pay you to get complete facts on B&W Allmul. May we send you additional information?

A Close-up view of butt weld furnace where electrically-fused B&W Allmul far outlasted mullite-type brick. B Another view of butt weld furnace — charging end.



B&W REFRACTORIES PRODUCTS: B&W Allmul Firebrick • B&W 80 Firebrick B&W Junior Firebrick • B&W Insulating Firebrick • B&W Refractory Castables, Plastics and Mortars

OTHER B&W PRODUCTS: Stationary & Marine Boilers and Component Equipment Chemical Recovery Units • Seamless & Welded Tubes • Pulverizers • Fuel Burning Equipment Pressure Vessels • Alloy Castings

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
REFRACTORIES DIVISION
GENERAL OFFICES: 161 EAST 42ND ST. NEW YORK 17, N.Y.
WORKS: AUGUSTA, GA.

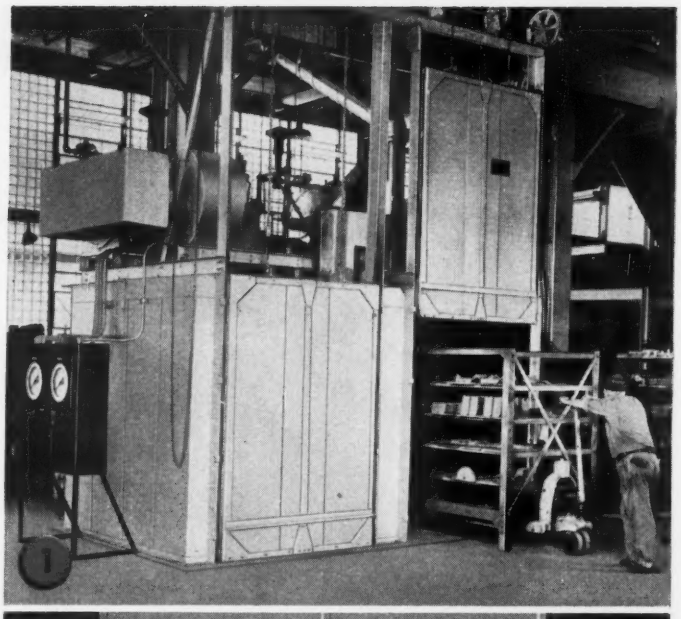
B&W

8925

carl mayer CAN DO IT

That's right, for any baking requirement there's a Carl Mayer oven that will do the job faster and cheaper, to give you the efficiency so necessary in today's competitive markets.

The exclusive heat recirculation and slotted panel construction features cut fuel costs and heating times by as much as 50%. Uniform temperatures, assured by heat recirculation, guarantee perfect baking conditions throughout the entire oven.

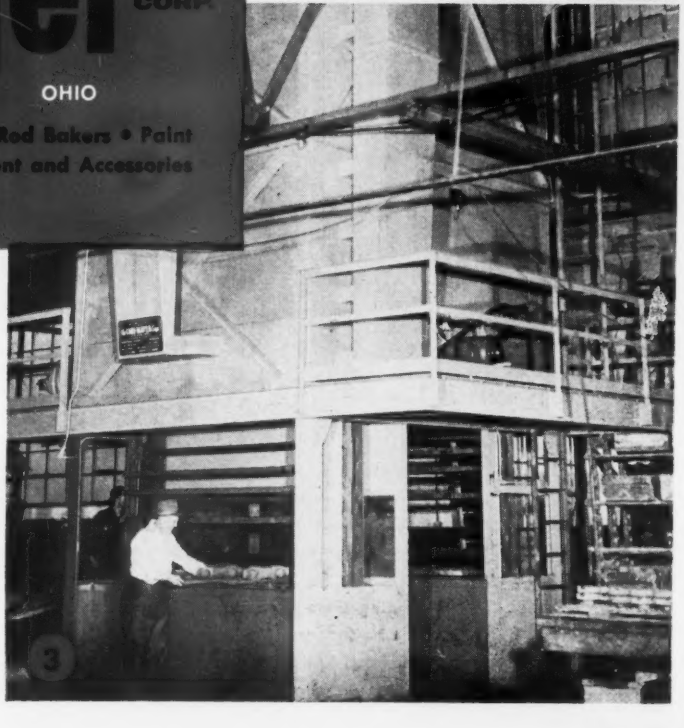


THE carl mayer CORP.

3030 EUCLID AVENUE CLEVELAND 15, OHIO

OTHER PRODUCTS: Heat Treating Ovens and Furnaces • Rod Bakers • Paint and Ceramic Drying Ovens • Special Processing Equipment and Accessories

Write for Bulletin 53-CM



Hundreds of modern foundries of all sizes have found the efficiency and economy of Carl Mayer ovens pay off. Find out for yourself. Our engineers will be happy to consult with you on your particular problem.

1. This rack type oven, with heat recirculation, holds temperatures within ±5° throughout the oven.
2. Patented downdraft heating method on this car type oven increases efficiency up to 50%.
3. This vertical oven features the patented internal heat fan — increases efficiency, lowers maintenance cost.

ALUMINIZED
Protective Clothing

Don't ROAST a good worker... put him in AO† ALUMINIZED CLOTHING

Reflects 90% of Radiant Heat!

AO aluminized asbestos not only reflects 90% of the radiant heat but is 50% lighter than ordinary asbestos. No wonder it's more comfortable to wear for long periods! Yes, and it's more durable and flexible — with good abrasion resistance. AO aluminized duck has the same high radiant heat reflective quality as AO aluminized asbestos and is recommended for milder exposures where molten metal splash is not a factor. With both fabrics you get the advantage of AO skilled tailoring in a complete line of gloves, mittens, coats, cape sleeves and detachable bibs, pants, chaps, aprons, hoods, leggings and spats. Your nearest AO Safety Products Representative can supply you.

142RA APRON

208BRA CAPE SLEEVE WITH DETACHABLE BIB

7X160RA LEGGING AND 7X161RA SPAT

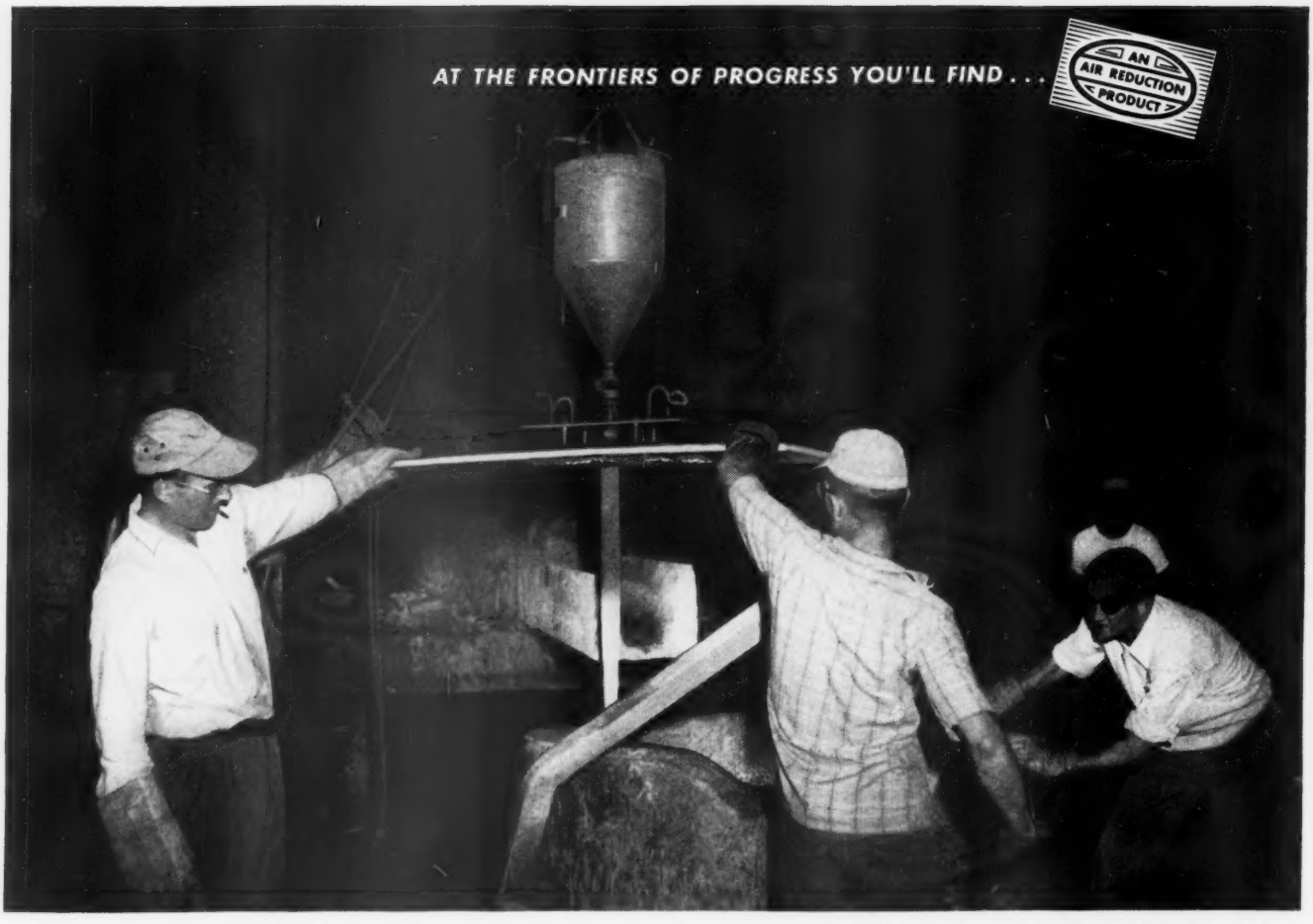
Recommended Uses

For protection against high heat (including direct radiation), sparks and molten metal splashes on such operations as — Open hearth, blast furnace and electric furnace tapping — Pushing of coke ovens — Cupola and ladle pouring — Exposures at glass tanks (molten glass) — Cutting, scarfing, any gas burning of metals.

†T.M. REG. BY AMERICAN OPTICAL COMPANY

American Optical
SAFETY PRODUCTS DIVISION

SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES



Lowering of Airco batch feeder into ladle for injection of calcium carbide.

Now! Gray-Iron foundries can reduce cost of producing ductile iron

INEXPENSIVE AIRCO CARBIDE INJECTION PROCESS CAN SAVE UP TO 50% BY REDUCING NEED FOR EXPENSIVE ALLOYS

Calcium carbide, dry nitrogen and a simple, inexpensive batch feeder are all that gray iron foundries need to reduce production costs of ductile iron, thanks to a new process developed by Airco.

When finely ground Airco No. 20 Special Carbide is injected with nitrogen into molten iron, the desulphurization is so uniform and efficient that ductile iron can be produced from acid cupola iron after carbide treatment. The low sulphur content of carbide treated irons—as low as 0.01% means the quantity of expensive alloys may be reduced with no sacrifice of mechanical qualities. Users of the new process have reported substantial savings by substituting less expensive alloys. Another feature of the process is its flexibility, since by using carbide treatment the same cupola charge may be used for producing a variety of grades of iron.

The new calcium carbide injection process is the result of Airco Technical Service's continuing effort to find new, profitable techniques for customers. If you have a cutting, welding or metallurgical problem, why not ask Airco to help you? Write to your nearest Airco office.

AIRCO®

AIR REDUCTION

60 East 42nd Street • New York 17, N. Y.

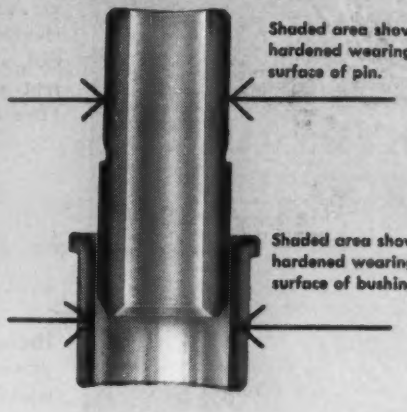
Divisions of Air Reduction Company, Incorporated, with offices and dealers in most principal cities

Air Reduction Sales Company
Air Reduction Pacific Company
Represented internationally by
Airco Company International
Foreign Subsidiaries:
Air Reduction Canada Limited
Cuban Air Products Corporation

Products of the divisions of Air Reduction Company, Incorporated, include: **AIRCO** — industrial gases, welding and cutting equipment, and acetylenic chemicals • **PURECO** — carbon dioxide, liquid-solid ("DRY-ICE") • **OHIO** — medical gases and hospital equipment • **NATIONAL CARBIDE** — pipeline acetylene and calcium carbide • **COLTON** — polyvinyl-acetates,—alcohols, and other synthetic resins.

carburized and hardened wearing surfaces increase life of UNIVERSAL flask pins and bushings

The wearing surfaces of Universal flask pins and bushings are carburized and hardened so they can take long, rigorous wear and rough treatment in the foundry. Both pins and bushings are double quenched and double drawn to produce strong ductile cores with a fine grain structure that will withstand considerable stress and strain without breaking. Universal flask pins and bushings are precision ground to extremely close tolerances to insure instant, accurate alignment of cope and drag. Plain, taper, round, hexagonal and threaded series pins and bushings are available in a complete range of sizes as regular stock items. For complete information, write to the office nearest you — Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wisc., or the home office.



184

UNIVERSAL ENGINEERING COMPANY FRANKENMUTH 4, MICHIGAN

Guarantee TOP Performance and Maximum Life!

Specify THESE TOP QUALITY FEATURES...

(Standard on Miller Cylinders at no extra cost)

Specify CASE HARDENED CHROME PLATED PISTON RODS

On all Air and Hydraulic Cylinders

Benefits To You

CASE-HARDENED Piston Rods (52-54 Rockwell "C") provide practically complete protection against damage from hammer blows, wrench-dropping, mishandling, and similar occurrences. ***Available from Miller at no extra cost.***

The HARD CHROME PLATING over the case-hardened rods protects against scratch-damage and rust. ***Available from Miller at no extra cost.***

Specify "TEFLON" WIPERS

On all Air and Hydraulic Cylinders

Benefits To You

"TEFLON" Rod Wipers and "TEFLON" Hydraulic Piston Rod Seals withstand temperatures from—100°F. to plus 500°F. They are impervious to practically all known chemicals, including the fire-resistant, special, and standard hydraulic fluids in current use. ***Available from Miller at no extra cost.***

Specify TEFLON HYDRAULIC ROD SEALS

On all Hydraulic Cylinders

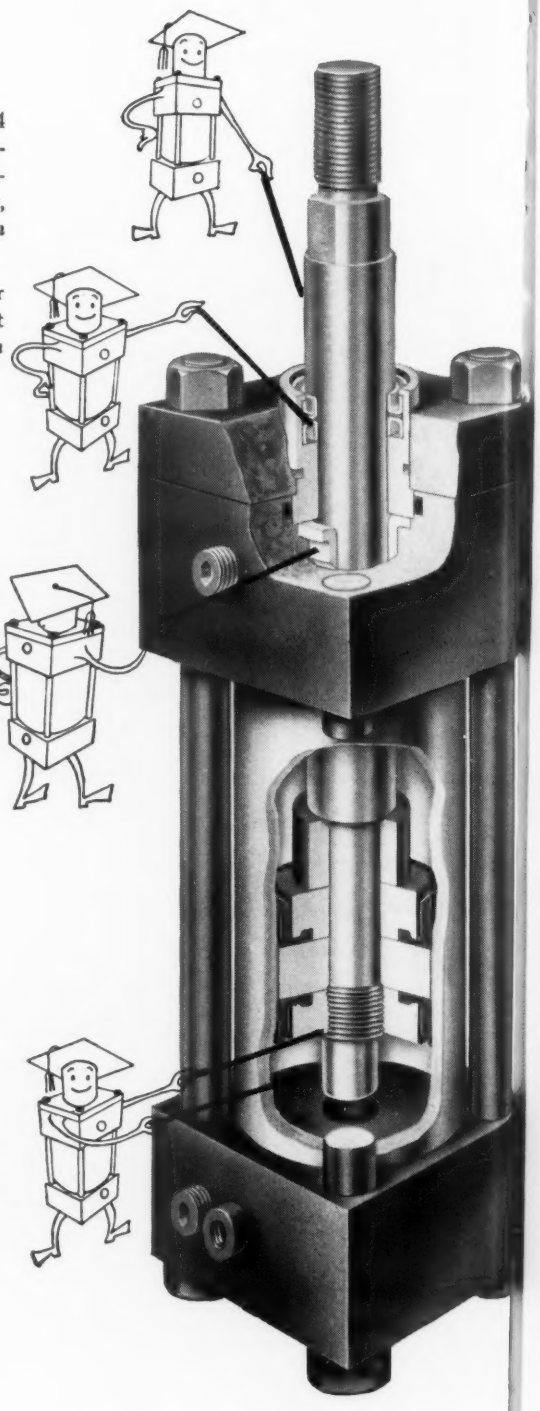
Specify RUST RESISTANT SURFACES

On all Air and Hydraulic Cylinders

Benefits To You

Highest quality Black Ferric Oxide Finish provides rust protection in air cylinder operation and on all cylinders during shipping and installation.

Cylinder heads, caps, mountings, pistons, followers, tie rods, and the unplated portions of the piston rods have this finish ***at no extra cost on all Miller cylinders.*** (This finish not recommended for water service)



You may wish to route this entire page to the proper department in your company, by using this handy form. Additional copies on request. →

To (Dept.) _____

"On all our future cylinder requirements, please specify the above quality features."

Signed _____

Title _____

EFFECTIVE DATES

These new Miller features will be provided at no extra cost after January 1, 1956—and at Miller's option prior to that date.

SALES AND SERVICE FROM COAST TO COAST

CLEVELAND • YOUNGSTOWN • DAYTON • TOLEDO • CINCINNATI • COLUMBUS
PITTSBURGH • PHILADELPHIA • BOSTON • HARTFORD • NEW YORK CITY
BUFFALO • ROCHESTER • MINNEAPOLIS • GRAND RAPIDS • DETROIT • FLINT
FORT WAYNE • SOUTH BEND • INDIANAPOLIS • MILWAUKEE • LOUISVILLE
KANSAS CITY • SEATTLE • LOS ANGELES • SAN FRANCISCO • BALTIMORE
DENVER • ST. LOUIS • MOLINE • CHICAGO • HOUSTON • ATLANTA
TORONTO, CANADA and OTHER AREAS

Miller

MILLER FLUID POWER CO.

2034 N. Hawthorne Ave., Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULA
COUNTERBALANCE CYLINDERS

In 1945-46 You Benefited . . .

From the following quality cylinder "Firsts" offered by Miller Fluid Power Company on its standard catalogued power cylinders:

☐ 1. Square bar steel heads, caps, and components
☐ 2. Welded fabricated steel mountings
☐ 3. Detachable, interchangeable steel mountings
☐ 4. High tensile steel tie rods (4 per cylinder)
☐ 5. High tensile steel piston rods
☐ 6. Chrome Plated Piston rods
☐ 7. Wrench flats on piston rods
☐ 8. Non-corrosive tubing on large bore air cylinders
☐ 9. Step-cut piston rings on hydraulic cylinders
☐ 10. Dirt wipers on air cylinders
☐ 11. Dirt wipers and oil wipers on hydraulic cylinders
☐ 12. Non-adjustable, bubble-tight, leakproof piston rod seals on air cylinders
☐ 13. Non-adjustable, bubble-tight, leakproof piston seals on air cylinders
☐ 14. Non-adjustable, leakproof, hydraulic piston rod seals guaranteed not to leak even one drop of oil
☐ 15. Non-adjustable, leakproof, hydraulic piston seals guaranteed not to leak even one drop of oil
☐ 16. 98% plus operating efficiency on air cylinders of 4″ and larger bores at 80 psi
☐ 17. 98% plus operating efficiency on hydraulic cylinders of 4″ and larger bores at 130 psi
☐ 18. 1 psi no-load break loose pressure on air cylinders of 3¼″ bore and larger
☐ 19. 3 psi no-load break-loose pressure on hydraulic cylinders of 4″ bore and larger
☐ 20. Seal life in excess of several hundred million feet of piston rod travel on all of the above-mentioned piston seals
☐ 21. Precision-seal cylinders
☐ 22. Seals that seal with pressure on all hydraulic static seals
☐ 23. Catalogued line of hydraulic cylinders of 2000 to 3000 psi operating pressure

In 1954 You Benefited again—from Miller's . . .

☐ 24. Sizable stock cylinder program
☐ 25. Model 77 heavy duty detachable foot mountings

In 1955 You Benefited again—from Miller's . . .

☐ 26. Greatly expanded stock cylinder program
☐ 27. Case-hardened, chrome plated piston rods
☐ 28. "Teflon" hydraulic piston rod seals
☐ 29. "Teflon" dirt wipers on air cylinders
☐ 30. "Teflon" dirt and oil wipers on hydraulic cylinders
☐ 31. High quality rust preventive finish on all parts not otherwise protected from rust on both air and hydraulic cylinders

Enter in boxes above the YEAR in which your supplier first (if at all) gave you these benefits.

In 1956, You Will Benefit Again . . .

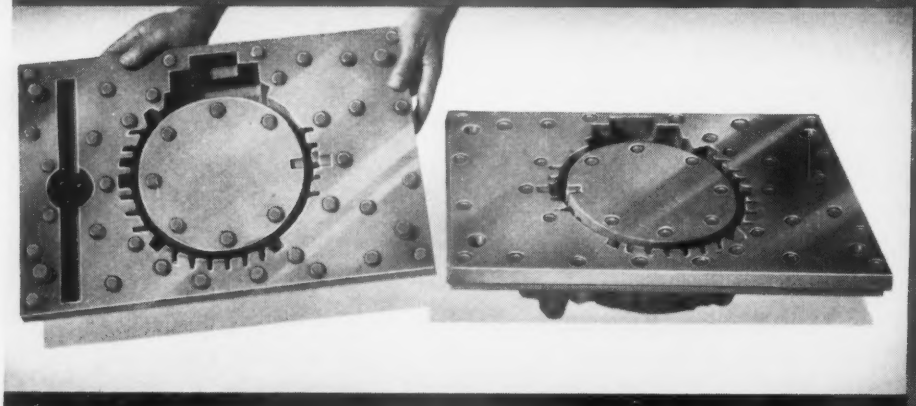
Miller

Watch For MORE Miller Firsts!

Miller

FOR FASTER CURES . . . SMOOTHER SURFACES . . . BETTER CASTINGS

CATALIN Shell Molding Resin 9616



The production advantages of the shell molding process have made a most important impact upon both the large and the small foundry. Its future is assured. New automatic machines and resin binders to keep pace with their speed are well past the laboratory stage.

Catalin Resin 9616, a phenol-formaldehyde, powdered, two-stage resin, has been specifically developed to bond the fine-grained sands used in the Shell Molding process.

This economical resin produces high-speed curing rates with the minimum of resin content. Savings are achieved in time, sand, work space, handling and metal. Castings are more accurate and smoother—require considerably less finishing.

In addition to Shell Molding Resin 9616, Catalin produces a wide range of core binding liquid resins and powders for the production of ferrous and non-ferrous metal castings.

Catalin representatives, familiar with the requirements of the foundry industry, are available for consultation. Samples on request! Write . . .

FOR FAST DELIVERIES . . . *Catalin maintains three strategically located resin plants . . .*

at FORDS, NEW JERSEY

THOMASVILLE, NORTH CAROLINA

and CALUMET CITY, ILLINOIS

CATALIN CORPORATION OF AMERICA
ONE PARK AVENUE, NEW YORK, N. Y.

Catalin

branch offices:
CHICAGO, ILL., 221 No. LaSalle Street
GREENSBORO, N. C., 630 Southeastern Bldg.

Busy Foundry Gets High Speed, Better Sand Control, Lower Maintenance with PEKAY AIRATORS

Surge loads of 300 tons per hour of thoroughly aerated, fluffed, lump-free sand—with the belt running at 311 ft. per minute—that's the kind of day in and day out production RIVERSIDE FOUNDRY of Bettendorf, Iowa, is getting on their No. 1 PEKAY AIRATOR unit. Units No. 2 and 3 on Riverside's two other systems are performing with similar efficiency.

And if you ask Joseph Avdek, Riverside's Plant Engineer, he'll tell you that the installation of these PEKAY AIRATORS was easy, and took amazingly few man-hours—with no major changes necessary in his belt systems. Another point Mr. Avdek likes, besides the steady efficiency with which his AIRATORS turn out properly aerated sand, is the ease of inspection of all moving parts through the AIRATOR sideplates, and the low maintenance which is already helping him to show lower operating costs.

In addition, Mr. Avdek knows from PEKAY's records of numerous other AIRATOR installations in various parts of the country that he can expect exceptionally long life and much less frequent replacement of wearing parts with this compact but ruggedly built equipment. Any way *you* look at it, the AIRATOR can help you get rid of a lot of your sand-conditioning problems—and you'll be pleasantly surprised at how low your outlay will be!

You'll find PEKAY's better engineered, high-efficiency equipment in plants large and small all over the country—*Slurry Systems, Mixer-Mullers, Troff-O-Matic Conveyors, M-T-Matic Elevator Buckets,* as well as AIRATORS.

SEND FOR COMPLETE DETAILS TODAY!

Specialists in Foundry Sand-Handling Engineering & Equipment

PEKAY MACHINE & ENGINEERING CO.

871 N. SANGAMON STREET CHICAGO 22, ILLINOIS

M-T-MATIC Elevator Conveyor Buckets
TROFF-O-MATIC Conveyors

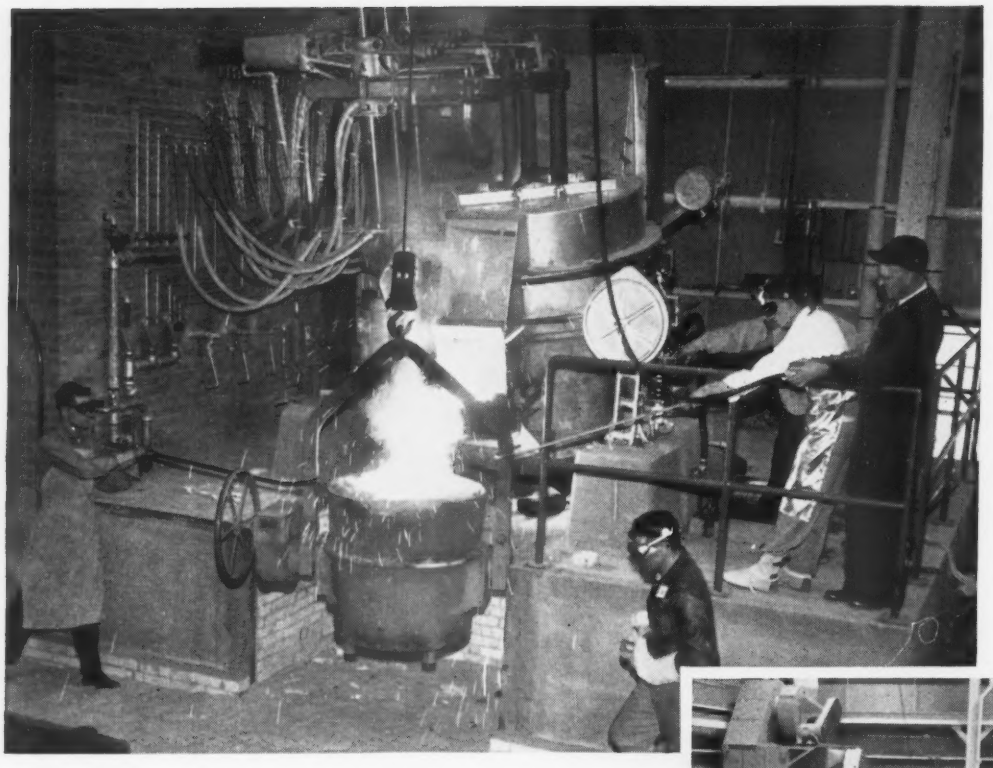
Gentlemen:

Please send me details and price information on the PEKAY AIRATOR

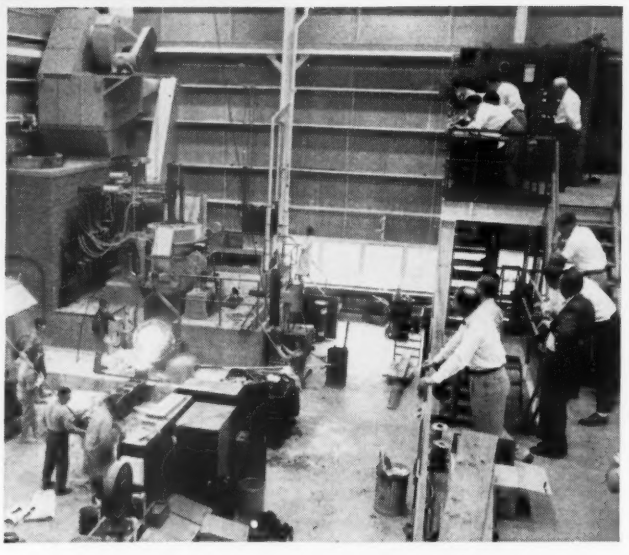
NAME _____ TITLE _____

COMPANY _____

STREET & NO. _____ CITY _____ ZONE _____ STATE _____



● Scientists, laboratory assistants and skilled operators work side by side to develop methods and materials at General Electric's new Metals and Ceramics Laboratory.



1-ton heats in this Lectromelt* furnace shorten the step from research to production

THIS Lectromelt Furnace is larger than you ordinarily see employed for research work. But General Electric's new laboratory was built "factory size" so that processes developed here could be transferred to production without the usual headaches. The 2,000-pound heats possible here are production runs in plenty of plants.

The high degree of accuracy with which temperatures and chemical make-up can be controlled in Lectromelt Furnaces makes them well suited to such research studies. Alloys and procedures developed on a pilot basis can then be duplicated day after day in other Lectromelt Furnaces, when they're turned over to the manufacturing department. Heats are uniform and quality is high.

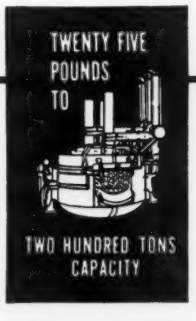
Catalog No. 9-A describes Lectromelt Furnaces for melting and refining. For a copy, write Pittsburgh Lectromelt Furnace Corporation, 314 32nd Street, Pittsburgh 30, Penna.

Manufactured in... GERMANY: Friedrich Kocks GMBH, Dusseldorf... ENGLAND: Birlec, Ltd., Birmingham ... FRANCE: Stein et Roubaix, Paris... BELGIUM: S. A. Belge Stein et Roubaix, Bressoux-Liege... SPAIN: General Electrica Espanola, Bilbao... ITALY: Forni Stein, Genoa... JAPAN: Daido Steel Co., Ltd., Nagoya.

*REG. T. M. U. S. PAT. OFF

MOORE RAPID

WHEN YOU MELT... Lectromelt



Shell molders...
for faster release, fewer rejects...

use DOW CORNING *Silicone* RELEASE AGENTS

Developed especially for the metal casting industry, Dow Corning *Silicone* parting agents assure clean, easy release every time with a minimum of build-up on even the most complex patterns. They reduce your cleaning costs to the vanishing point, and speed production of uniform shells. See for yourself — send for *free samples* today!

Water dilutable type

DOW CORNING 8 EMULSION

Widely approved by leading shell machine and resin manufacturers for applications where solvents cannot be tolerated. Noncorrosive and nonflammable, Dow Corning 8 Emulsion is easily diluted in hard or soft water . . . resists creaming or separation, both after dilution and in storage.

New solvent type

DOW CORNING F-452 FLUID

One application of this new, easily diluted solvent type silicone parting agent provides easy release for several resin-sand shells. Easily applied to either hot or cold patterns . . . wets surface rapidly . . . leaves uniform silicone film that's heat-stable and oxidation resistant.

NOTE **— for best pattern break-in, use Dow Corning 7 Compound.**

send for FREE SAMPLE!

1955 AWARD — CHEMICAL ENGINEERING ACHIEVEMENT

DOW CORNING CORPORATION
MIDLAND, MICHIGAN

Dow Corning Corporation
Dept. 5901,
Midland, Mich.

Please send me:

- ☐ Free sample of Dow Corning 8 Emulsion
- ☐ Free sample of Dow Corning F-452 Fluid
- ☐ Free sample of Dow Corning 7 Compound

NAME_____

COMPANY_____

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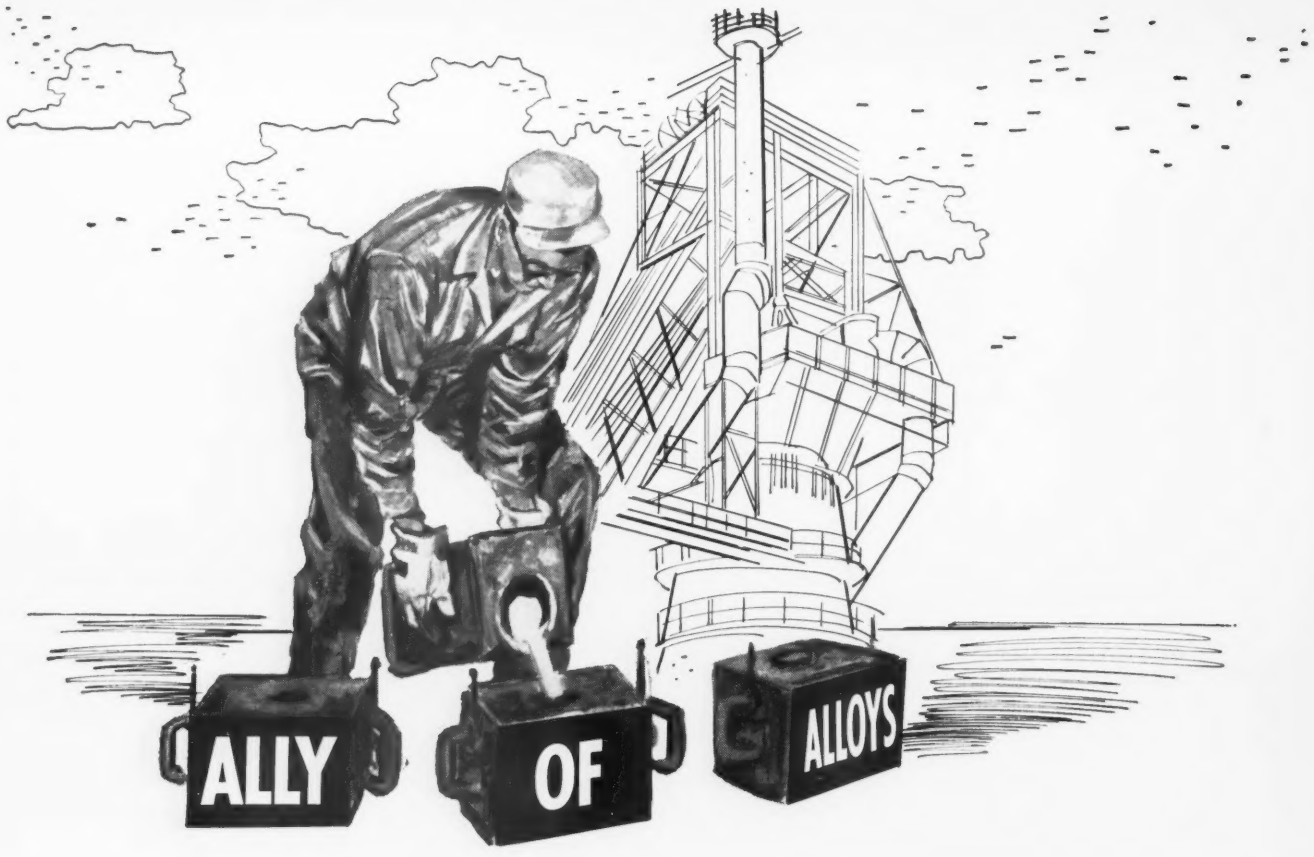
CITY_____ ZONE_____ STATE_____

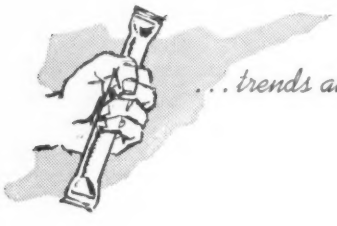


...the Miracle Metal ... LITHIUM

Lithium, like metallurgy, has come a long way. Once a laboratory curiosity, lithium is now the "catalyst of industry." Once the art of separating metals from their ores, metallurgy now embraces a whole new industry devoted to the manufacture and treatment of the alloys of these metals. And now—still another new field within a field—Lithium Metallurgy.

Lithium Ingots are used in the degasification of copper. Lithium Cartridges are used in the refinement of high temperature copper, and in brass, bronze and nickel-silver castings. Even the salts of lithium (Carbonate and Chloride, specifically) hold great promise for heat treating.

Lithium metal and its compounds could hold the same hope for *you*. We will be happy to discuss it at your convenience.



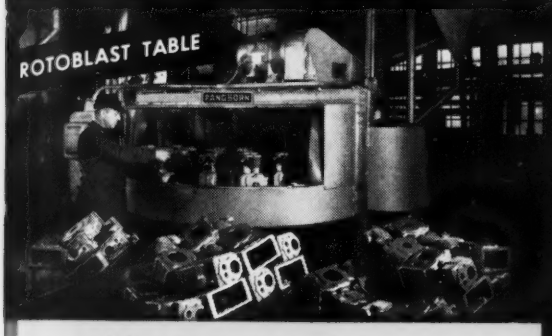
... trends ahead in industrial applications for lithium

LITHIUM CORPORATION OF AMERICA, INC.
2600 RAND TOWER
MINNEAPOLIS 2, MINN.

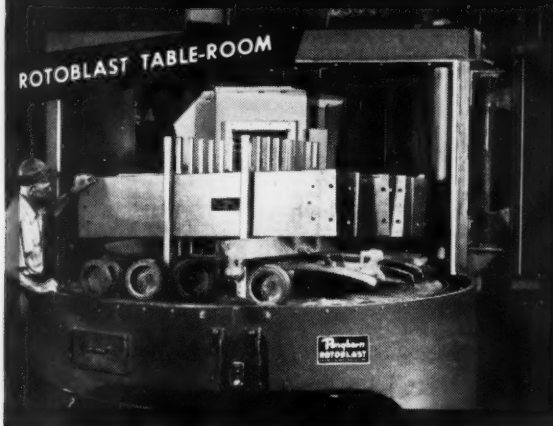
MINES: Keystone, Custer, Hill City, South Dakota • Bessemer City, North Carolina • Cat Lake, Manitoba • Amos Area, Quebec • BRANCH SALES OFFICES: New York Pittsburgh • Chicago • CHEMICAL PLANTS: St. Louis Park, Minnesota • Bessemer City, North Carolina • RESEARCH LABORATORY: St. Louis Park, Minnesota

Faster...

better...



cheaper...



Faster, better, cheaper—these are no empty claims. There are sound reasons why Pangborn Rotoblast offers these benefits. Rotoblast gives you faster blast cleaning because it throws a greater volume of abrasive over a specific area in less time. It does better cleaning because its cleaning action is uniform, scouring surfaces to a bright, gleaming finish. It cleans cheaper because, in addition to speed, Rotoblast saves labor costs and requires less power to operate. (Rotoblast is versatile, too, handling all kinds and sizes of products!) Investigate Pangborn Rotoblast now!

that's blast cleaning with Pangborn Rotoblast®!

Send for free copy of Bulletin 214 today! The few minutes you take to write can save you thousands of dollars annually. Write PANGBORN CORP., 1400 Pangborn Blvd., Hagerstown, Md. *Manufacturers of Blast Cleaning and Dust Control Equipment.*

Pangborn

BLAST CLEANS CHEAPER

Rotoblast Blastmaster® & Continuous-Flo Barrel

Rotoblast Tables & Table-Rooms

Special Blast Rooms & Cabinets

Pangborn Dust Control Equipment

Malleabrasive Shot & Grit

Powder-washing blowpipes have replaced swing grinders and chippers in removing defects and riser pads from railroad diesel trucks. Work is done faster and more efficiently—preheating is rarely necessary.

Powder-washing blowpipes remove riser pads in locations virtually impossible for other methods. Risers between flanges of this valve body have already been washed away—note the smooth clean finish.

Why Powder-Washing is a Standard Tool in Modern Foundries

Powder-washing is the fastest, most efficient method for gouging and removing fins, pads, and stubs from casting surfaces and hard-to-reach places.

* Powder-washing is faster than grinding or chipping, and finished surfaces are clean and smooth.
* Powder-washing tools are quiet, easy to operate, and less fatiguing than chipping tools and grinders.
* In powder-washing, metal powder is added to the washing flame. This raises its temperature, and provides greater speed and control in cleaning sand and metal from castings. This process is effectively used to gouge or wash iron, steel, bronze, and some of the more complex oxidation resistant alloys.

Your local LINDE representative will be glad to give you detailed information on the powder-washing process, and help you determine the setup to best serve your foundry needs. Save time and money—call him today.

LINDE AIR PRODUCTS COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
Offices in Other Principal Cities
In Canada: LINDE AIR PRODUCTS COMPANY
Division of Union Carbide Canada Limited, Toronto
(formerly Dominion Oxygen Company)

Linde
TRADE-MARK

"Linde" is a registered trade-mark of Union Carbide and Carbon Corporation.

30 TONS PER HOUR

performance only a PAYLOADER® can deliver

This 1955 model HA is the youngest of three "PAYLOADER" units working at Pennsylvania Malleable Iron Corp., Lancaster, Penn. It is also the most productive tractor-shovel for its size that they have ever seen. Mr. E. F. Stolpe, the owner says, "Believe the new HA the best machine for our operations." It is used mostly for handling sand and coal — moves 30 tons per hour, 55 hours per week.

Hundreds of other owners of the new model HA are equally enthusiastic and pleasantly surprised by the superior performance and greater capacity of the new model HA. "Rollback bucket carries more material" . . . "does the work of two machines on some operations" . . . "less spillage and practically no floor clean-up" are some of the actual comments from other owners.

It will pay you to find out what a "PAYLOADER" can do for your material handling problems. Your "PAYLOADER" Distributor is ready to show you. Use the handy coupon opposite.

For higher lifts and more capacity — the new model HAH 1 cu. yd. capacity

THE FRANK G. HOUGH CO.
703 Sunnyside Ave. • Libertyville, Ill.

- ☐ Send data on Model HA (18 cu. ft.)
- ☐ on new model HAH (1 cu. yd.)
- ☐ on larger models

Name_____

Title_____

Company_____

Street_____

City_____

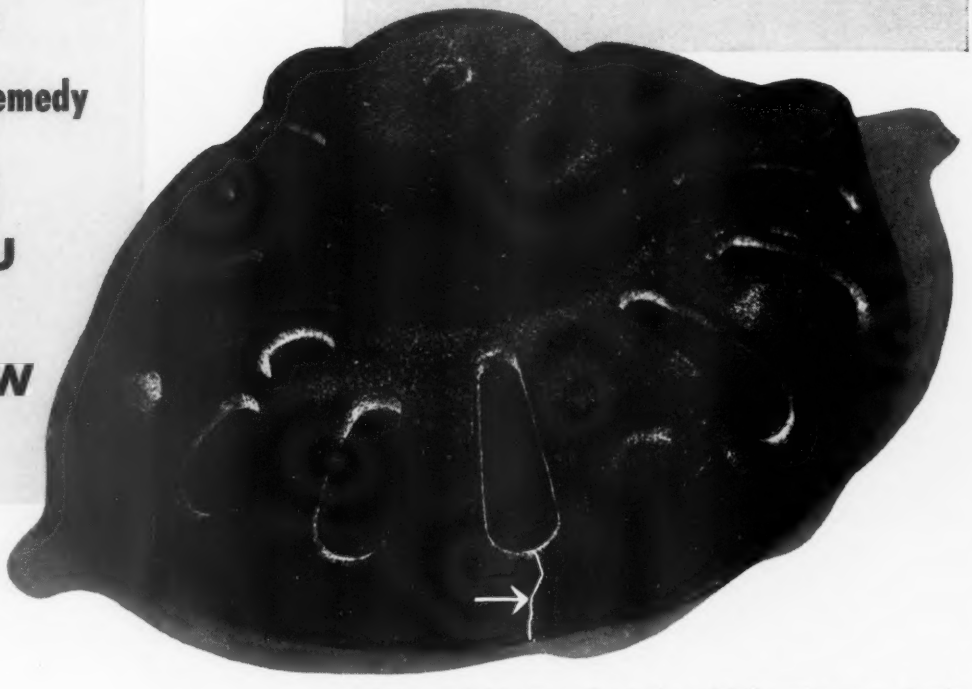
State_____

PAYLOADER®
MANUFACTURED BY
THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.
SUBSIDIARY—INTERNATIONAL HARVESTER COMPANY

Every Crack Has a Cause!

Inspection with MAGNAFLUX* at the *RIGHT* times

- Finds the Cause
- Suggests the Remedy
- Reduces Rejects
- SAVES YOU MONEY
- BUILDS NEW BUSINESS



Crack as revealed by Magnaflux in the end-bell casting on an electric motor. Crack is the result of improper handling.

Not *all* cracks are serious. It depends upon the type, size and location. But in the few areas where stress is high, even a tiny crack can be important, because it raises the stress still further.

The *right* time to find cracks is when they *first* occur. This may be anywhere from pilot run to handling for shipping. Wherever it is, sampling inspection with Magnaflux finds and clearly marks the defect to point to the cause.

By finding serious defects early in processing, you can determine *where* they occur and how to correct them — before parts are run in quantity and later rejected. Correction often involves only a minor change in design or feeding procedure, or in cleaning or handling, with each change checked by Magnaflux in pilot runs. This results in a production run with almost no rejection due to cracks. It leads to castings with even stress flow, that are cheaper to pour, lighter, stronger and better looking.

With RELIABLE castings cheap to make, many foundries that use inspection with Magnaflux are now selling castings where formerly more costly parts were used.

Find out now how inspection with Magnaflux can help you produce better castings, at lower cost to a bigger market! Ask to have a Magnaflux Engineer call and give you the facts.

*Magnaflux is a Registered Trademark of Magnaflux Corporation

MAGNAFLUX

MAGNAFLUX CORPORATION
7350 West Lawrence Ave. • Chicago 31, Ill.
New York 36 • Pittsburgh 36 • Cleveland 15
Detroit 11 • Dallas 19 • Los Angeles 58

Here's How HYSTER® *PLANNED* MATERIALS HANDLING SAVES TIME AND MONEY in foundries

Here are typical examples of how Hyster Industrial Trucks are helping to make *tremendous* savings in materials handling costs in *foundries.*

Whether you are now using lift trucks, or haven't ever used industrial trucks of any kind, your Hyster Dealer is ready to help you achieve cost reductions. Because he keeps abreast of the materials handling problems and improvements, he has helped many foundries realize more profit from their operations. *Why not call him today* and take advantage *of his specialized services? Materials Handling Trucks from 1,000 to 30,000 pound capacities.*

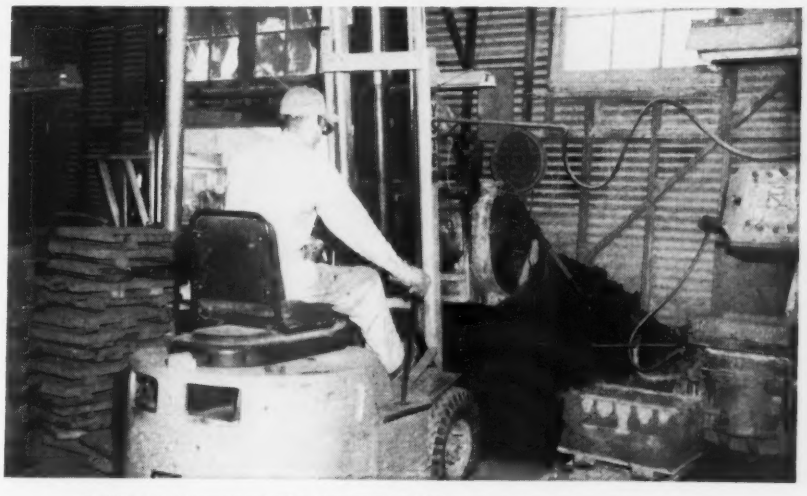
HYSTER XA-60 LIFT TRUCK maneuvers steep ramp from ground level to loading dock carrying a load of 10″ soil pipe sections 53″ long. A southern foundry operation.

HYSTER DEALERS GIVE YOU ALL 3

1. PLANNING. Your Hyster Dealer will plan your materials handling operation from scratch — or will analyze your present system to see if it can be improved.

2. THE RIGHT TRUCK for *your* job from Hyster's complete line of industrial trucks (1,000-30,000 lbs) and over 100 job-attachments.

3. THE RIGHT SERVICE—ample spare parts stock, shop facilities, factory-trained mechanics and an efficient field service that keep your Hyster lift trucks going on your job, wherever your job might be located. Hyster trucks are noted the world over for their low downtime.



HIGHLY MANEUVERABLE HYSTER QN-20 with scoop dumping sand at molders bench. Also used to move castings, molds and other materials inside and outside.

HYSTER COMPANY

2902-30 N. E. Clackamas.....Portland 8, Oregon
1010-30 Myers Street.....Danville, Illinois
Hyster N.V. .....Nijmegen, The Netherlands

FOUR FACTORIES: Portland, Oregon; Danville, Illinois; Peoria, Illinois; Nijmegen, The Netherlands.

Measured Blast Moisture Means Money to You!

Section of Foxboro Dew Point Chart (above) shows what happened to humidity within one eight-hour period! From +24° D.P. (18.2 gr./lb.) to —4° D.P. (4.46 gr./lb)! But, by following chart, operator was able to vary amount of coke to balance moisture changes.

Foxboro direct-reading Dew Point Recorder assures correct coke charge – hot heats every pour

You can accurately compensate for the widest **variations** in blast moisture . . . pour consistently **hot** heats every day using the Foxboro Dew Point Recorder. Its *continuous* chart record of atmospheric moisture provides a foolproof basis for modifying the coke charge . . . eliminates coke waste and costly "cold metal" pours.

And you don't have to "baby" *this* Recorder. Accuracy is unaffected by ambient temperature changes. No critical adjustments . . . practically no maintenance! Step up efficiency *and* economy in *your* cupola operation. Write, or ask your nearby Foxboro Field Engineer for Data Sheet 330-1 on recording, and control, of blast moisture.

THE FOXBORO COMPANY, 321 NEPONSET AVENUE, FOXBORO, MASS., U. S. A.

FOXBORO
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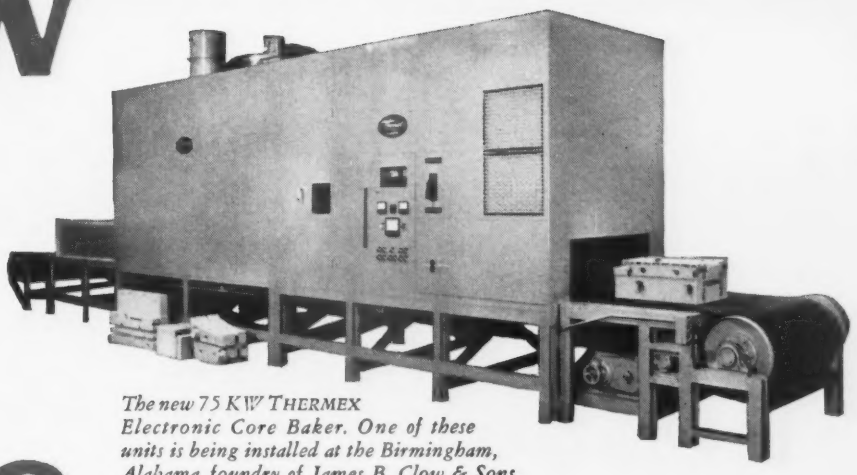
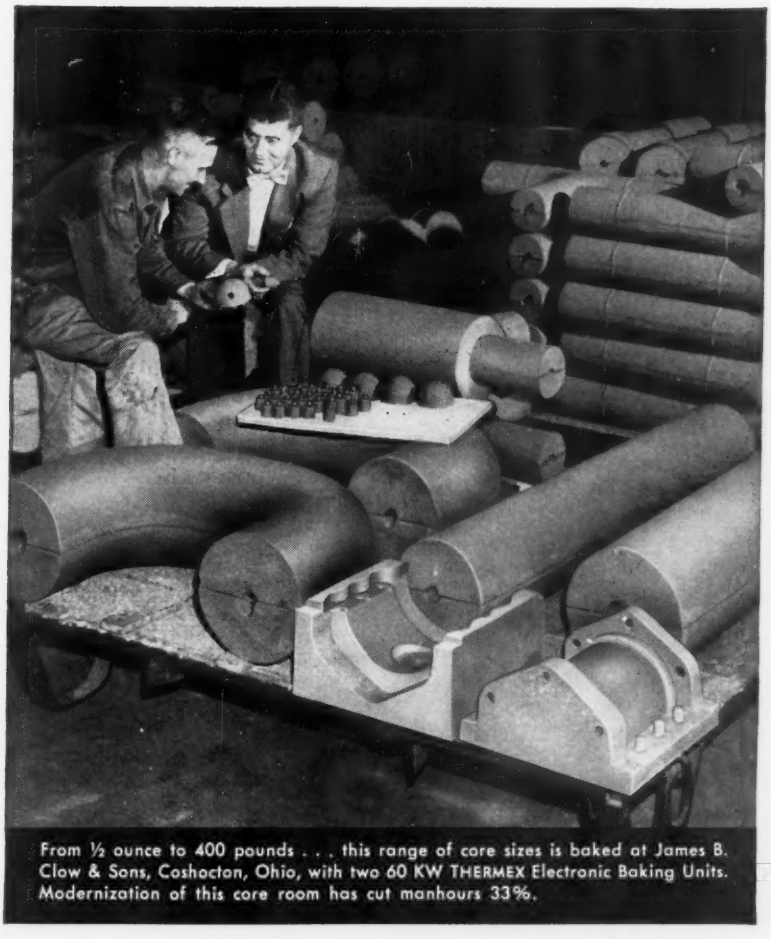
DEW POINT RECORDERS

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND

how you cut costs when you improve core quality



The new 75 KW THERMEX Electronic Core Baker. One of these units is being installed at the Birmingham, Alabama foundry of James B. Clow & Sons.



From ½ ounce to 400 pounds . . . this range of core sizes is baked at James B. Clow & Sons, Coshocton, Ohio, with two 60 KW THERMEX Electronic Baking Units. Modernization of this core room has cut manhours 33%.

Thermex®
ELECTRONIC CORE-BAKING EQUIPMENT

BEFORE MODERNIZATION of this core room, cores had to be reinforced with steel rods to keep them from sagging. Now, with THERMEX* Core Baking Units, high-speed, high-frequency heating practically eliminates sagging. Elimination of the rod reinforcing saves manhours and rod costs.

With electronic baking you get uniform, fast baking and smooth, hard surfaces on cores of all sizes. You can reduce core loss due to breakage in handling and pouring. And, dielectrically baked cores can reduce shakeout and cleaning costs.

Find out how *you* can cut *your* foundry costs with THERMEX Electronic Baking Equipment. The Girdler Company, Thermex Division, Louisville 1, Kentucky.

*THERMEX—Trade Mark Reg. U. S. Pat. Off.

the GIRDLER Company

A DIVISION OF NATIONAL CYLINDER GAS COMPANY

THERMEX DIVISION

Custom Built in
any Length, Width or Depth

ADAMS CHERRY EASY-OFF FLASK

These advantages will cut your production costs!

SIDES AND ENDS finished 1⅛" on all standard size flasks. 1¼" and heavier on flasks of larger perimeters and depths. Cherry lumber is finest available; air dried.

SOLID CORNERS are machine locked to maintain alignment and to insure maximum rigidity.

MALLEABLE TRIMMINGS are another famous Adams feature; assure long life and exceptional service.

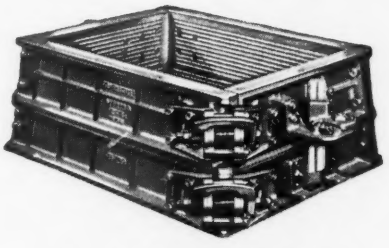
OPERATING MECHANISMS are completely new in design, yet of proven construction. Exceptionally simple, offering single-point adjustment; ease of operation on tough jobs.

ADJUSTMENTS made *only* when mechanism is in *locked* position.

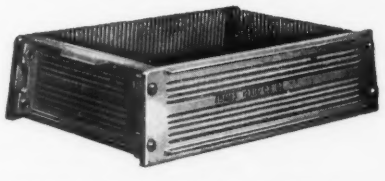
SPECIALLY DESIGNED INSERTS located in main body castings permit reversal of locking position. As "standard" flasks are furnished with handles locking in "up" position. To change, remove main bolt handles and inserts, reverse inserts and handles and reassemble.

STEEL PROTECTING STRIPS are standard equipment at top of cope, bottom of drag and at parting. Aluminum strips available upon request at no extra charge.

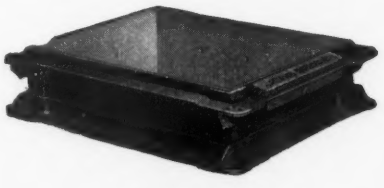
WIDE "V" PINS & EARS standard on all flasks. All other types of pin and ear arrangements are available to interchange with your present pattern plate guides.



Adams Aluminum Easy-Off Flask



Adams Jackets, Cast Iron or Aluminum



Adams Steel Jackets

Write us today for further details . . .

Cherry Snap Flasks — Cherry Slip Flasks — Aluminum Slip Flasks — Easy-Off Flasks — Cherry Presser Boards — Wood Bottom Boards — Steel Bottom Plates — Steel Jackets — Aluminum or Cast Iron Jackets — Steel Bands — Steel Upsets — Cherry or Aluminum Upsets

The ADAMS Company

Established
1883

MOLDING MACHINES
and
FLASK EQUIPMENT

700 FOSTER STREET, DUBUQUE, IOWA, U.S.A.

news FROM LIQUID CARBONIC

1. MIX SAND AND BINDER

Inexpensive liquid binder is mixed with any clay-free core sand in conventional mulling machine.

2. PACK CORE BOX IN USUAL WAY

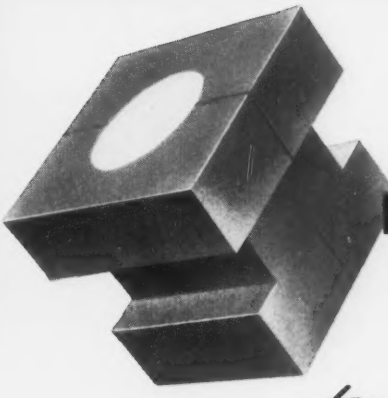
Sand should be cold. CO_2 hardening is adaptable to all types of core making machines.

3. APPLY CO_2 GAS

Several methods are satisfactory. A 15-to-20-second application of CO_2 cures core completely.

4. CORE IS READY FOR USE

Cores may be used immediately without stockpiling.



from **PACKED CORE BOX**

to **CURED CORE**

in 20 seconds flat!

CO_2 curing is the answer! Cores are cured by instantaneous chemical reaction. CO_2 gas reacting on a special sand binder completely eliminates time-consuming baking. You get sound, hard, perfectly formed cores and molds — *of any shape or size* — with almost unbelievable speed. Another important advantage —CO_2 cured cores are hardened right in the box—thus giving more accurate dimensions.

CO_2 core curing is as foolproof as it is fast. The photos show the four simple steps to faster, perfectly cured cores and molds. Want the *complete* story? Just mail the coupon below.

FREE BULLETIN *gives the complete story on CO_2 core hardening process. Mail the coupon for your copy.*

THE LIQUID CARBONIC CORPORATION
3150 South Kedzie Avenue • Chicago 23, Illinois

Please send me your Bulletin No. 5644 on CO_2 Core and Mold Curing.

Name_____

Title_____

Company_____

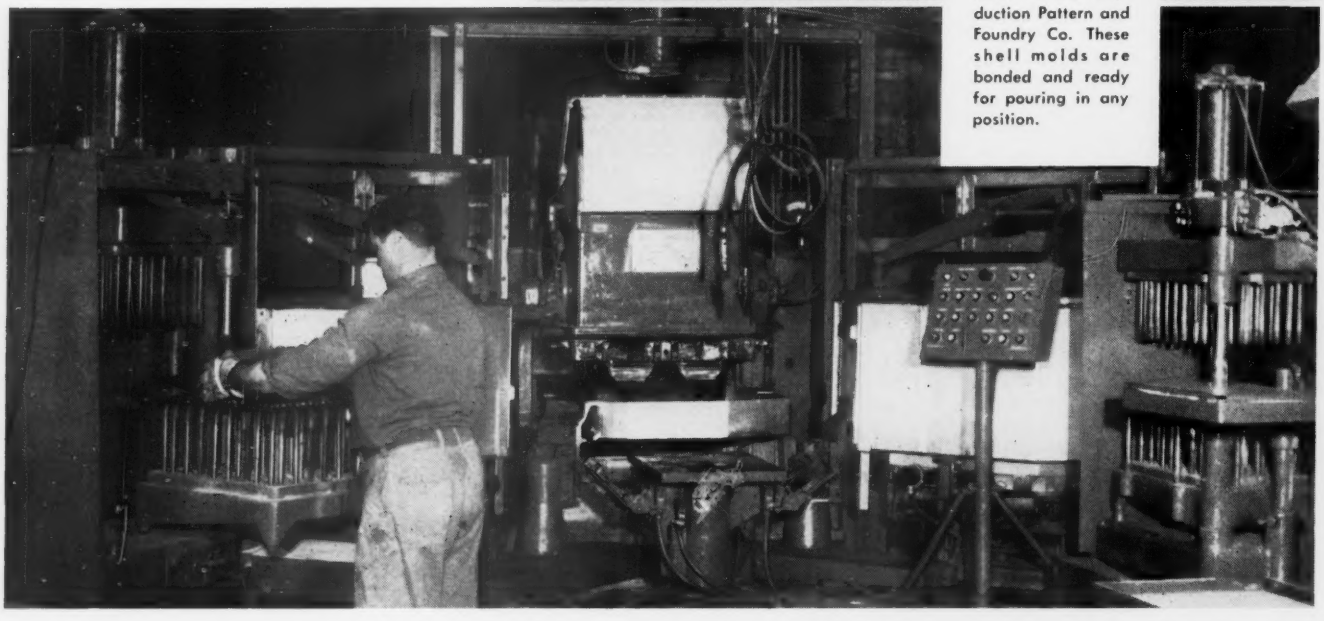
Address_____

City _____ Zone____ State_____

POURING SHELL MOLDS by the * ACRE!

*

This 'Acre' of shell molds (284) is just ½ day's work by one unskilled operator of the 'Chicopee Twin' at the Production Pattern and Foundry Co. These shell molds are bonded and ready for pouring in any position.



'Chicopee Twin' Set-up Produces Shell Molds, Ready for Pouring—at Phenomenal Rates!

THE MOST PRODUCTIVE ONE-MAN SHELL MOLDING MACHINE EVER DEVISED

More shell molds per man hour than any other shell molding machine. This compact set-up of a 2-station molding machine and bonders is operated by a single unskilled worker. The 'Chicopee Twin' and companion shell bonders speedily produce top quality shell molds ready for pouring . . . vertical, horizontal or diagonal! The resulting castings are so smooth and uniform that you can save approximately 50% on machining operations alone!

No strip heaters used in pattern plates . . . engineered for self-alignment at investment and ejection stations regardless of temperature variations.

Equipped with fully automatic sand feed for uninterrupted operation of one or both stations. Handles two different patterns at once!

Oversize hydraulic unit provides source of energy for pattern and investment chamber movements. Extremely long bearing cylinder assures positive square ejection stroke. No damaged shells.

The 'Chicopee Twin' has countless other advanced features which we would like to illustrate by demonstration. For additional information, please write direct using your own letterhead.

Write FOR DESCRIPTIVE LITERATURE AND SPECIFICATIONS

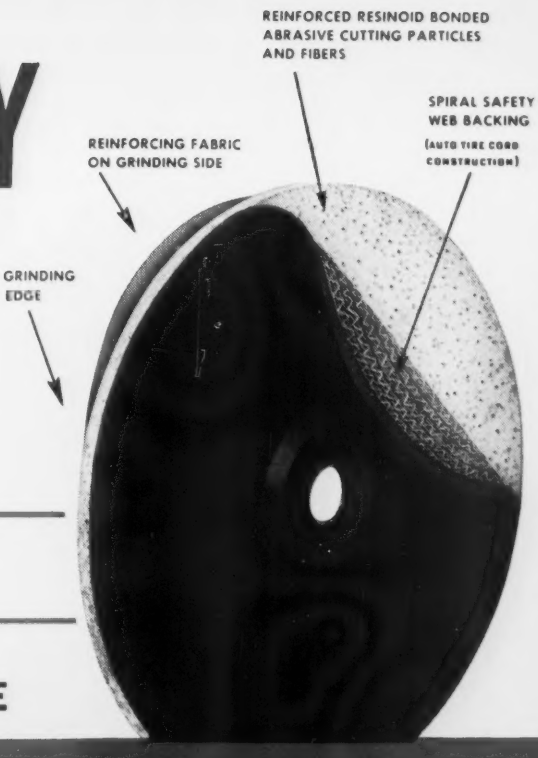
SHELL PROCESS, INC.
360 McKINSTRY AVENUE · CHICOPEE, MASS.

Manufacturers of Shell Molding Machines & Shell Core Blowers

STRUCTURALLY DIFFERENT...

FOR EXTRA STRENGTH

EXTRA SAFETY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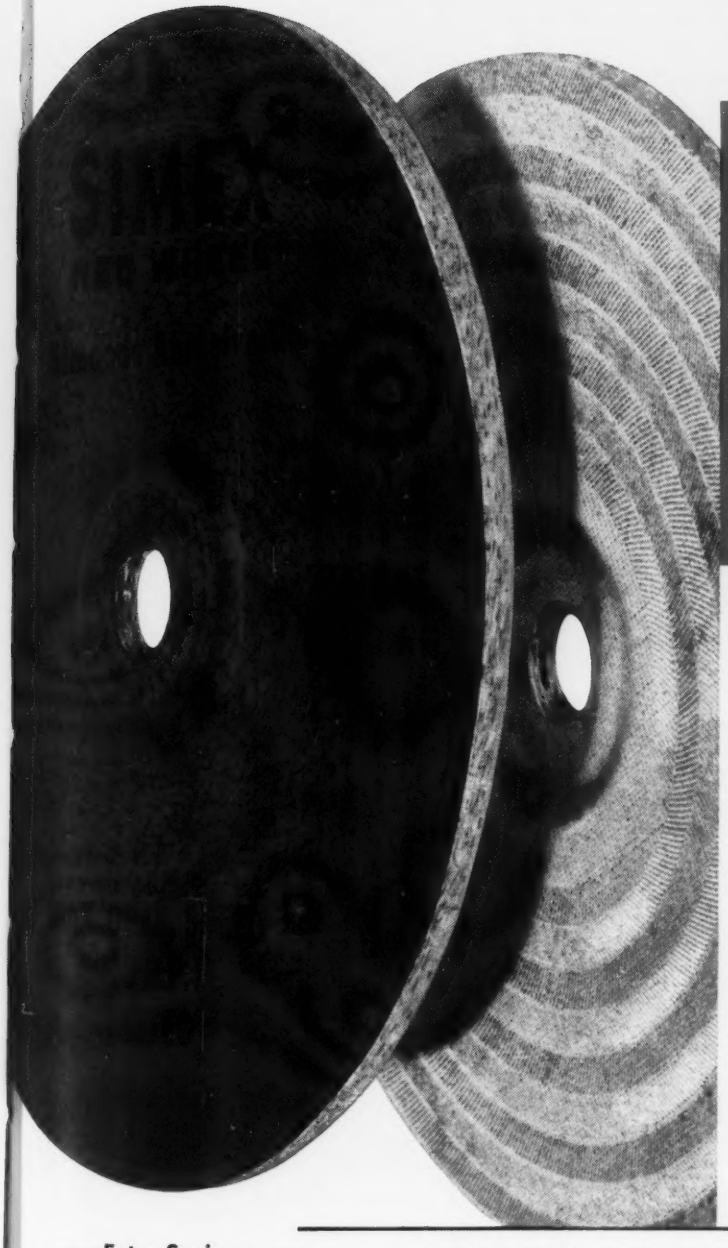

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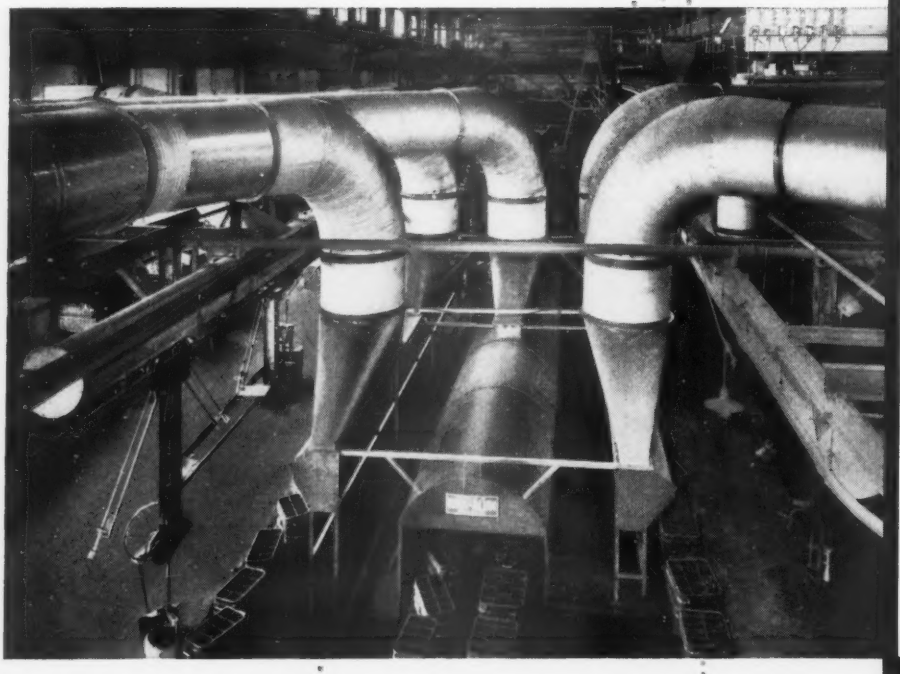

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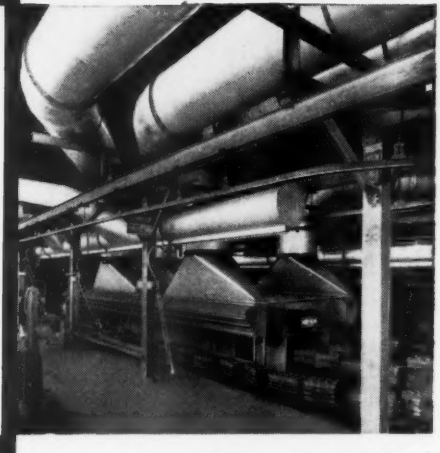
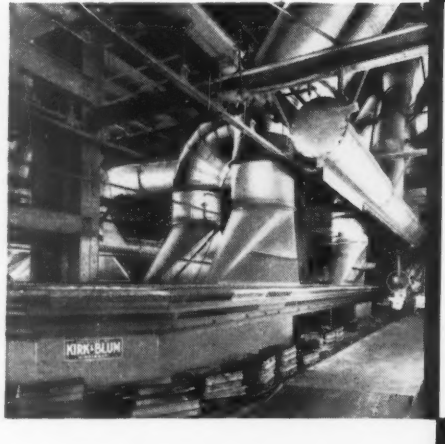


Fume exhaust system and forced air cooling of working area



Core cooling, fume exhaust and worker cooling arrangement

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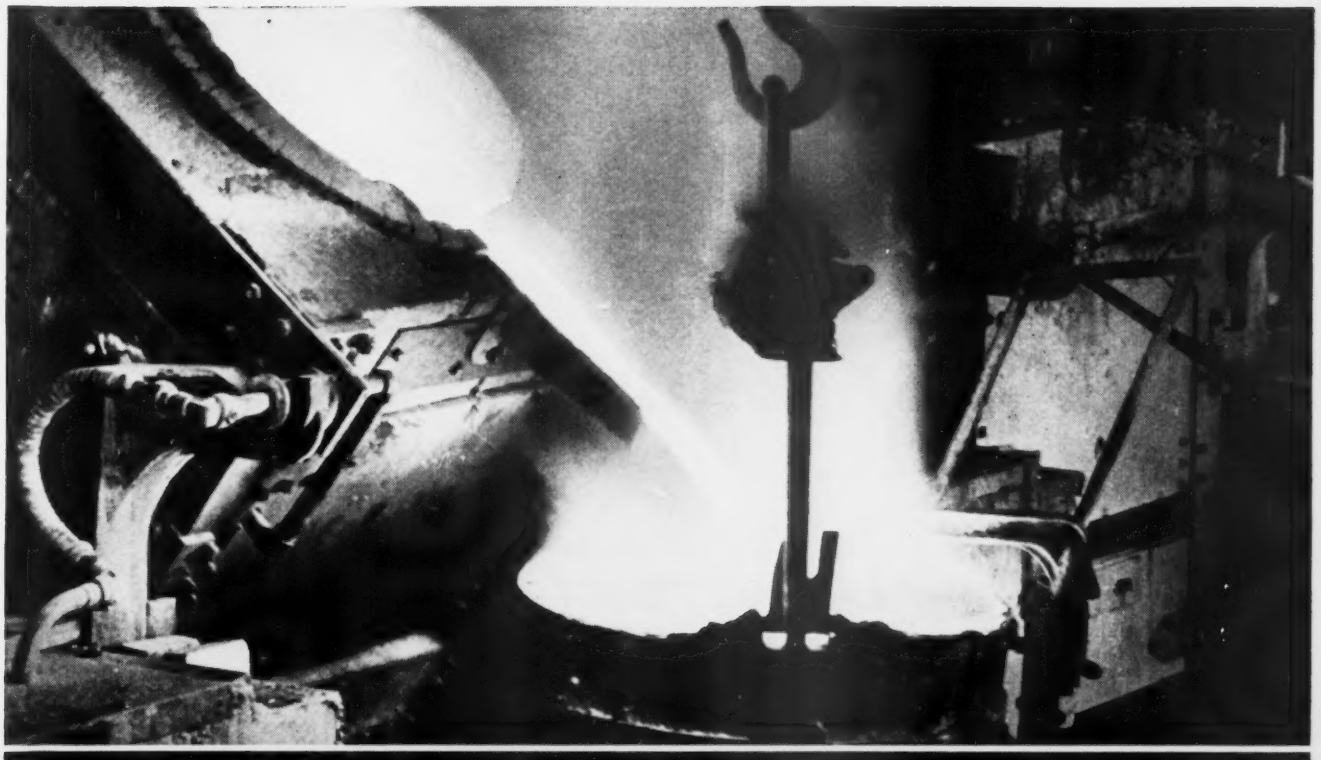

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Ajax has been building induction furnaces for all metals since 1916. Installations capable of producing up to 20,000 pounds of metal per hour are in operation, and more and more foundries are switching to Ajax-Northrup melting as they discover its economy and advantages. Learn why in Bulletin 27-B, available upon request to Ajax Electrothermic Corporation, Trenton 5, New Jersey.

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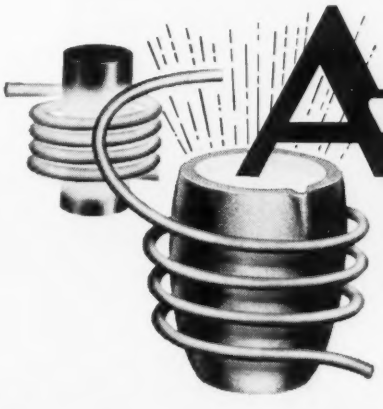

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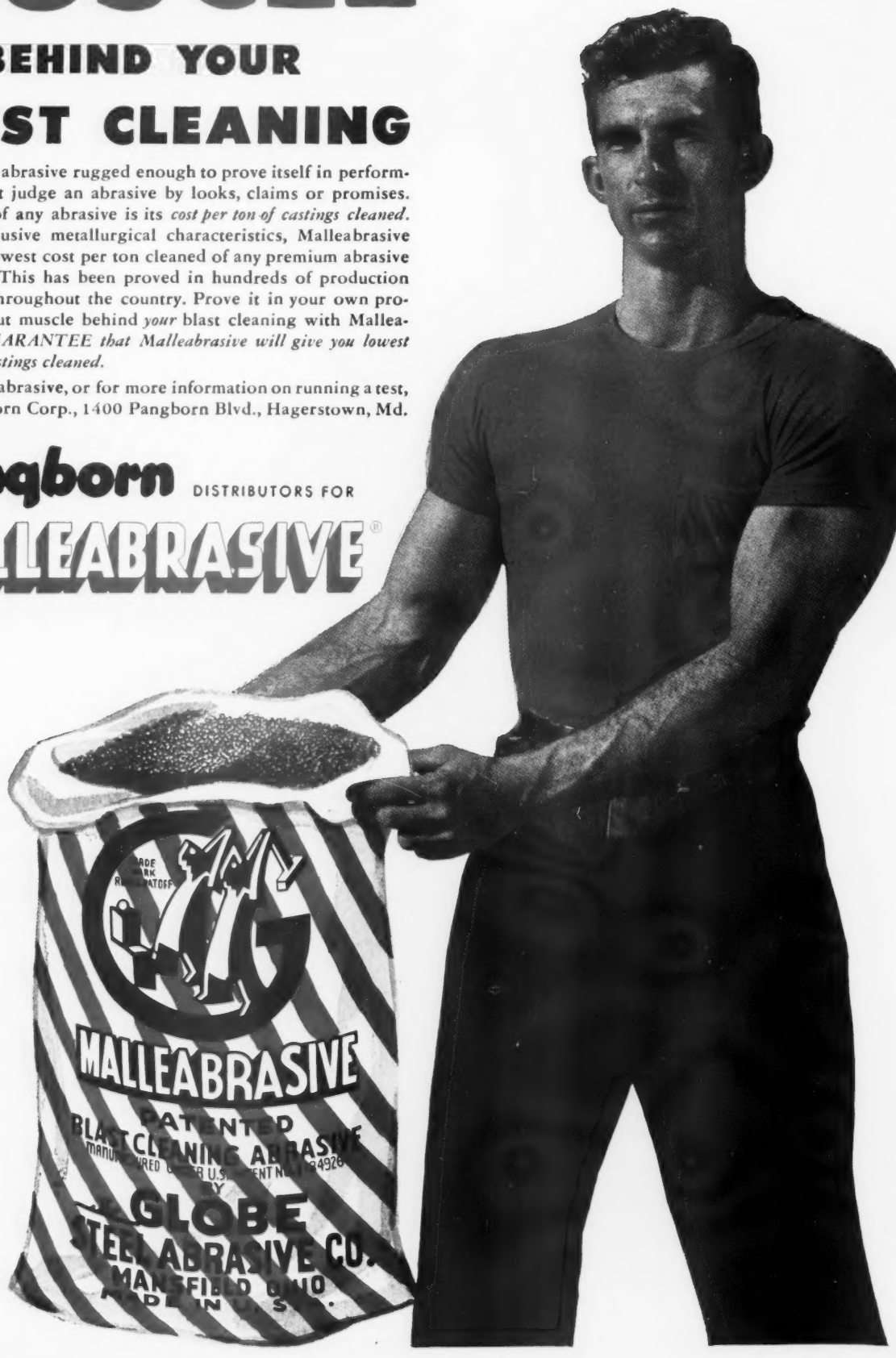
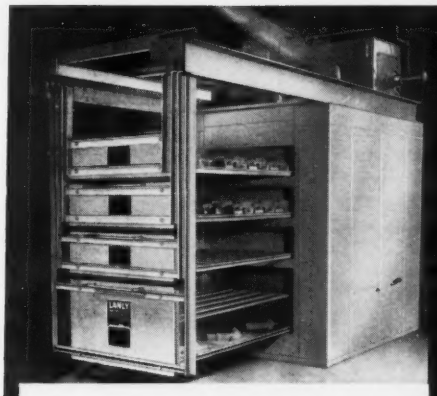
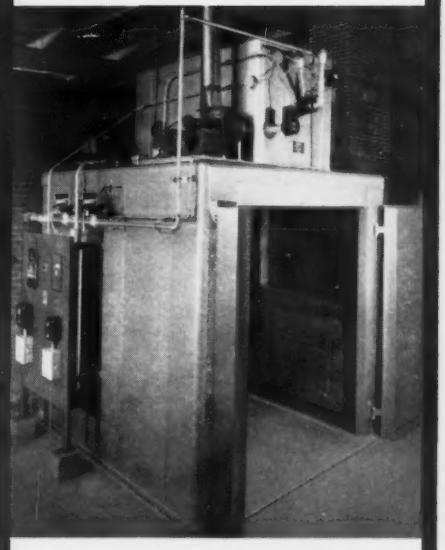


*U.S. Patent #2184926
(Other patents pending)



Drawer, . . .

. . . Rack, or



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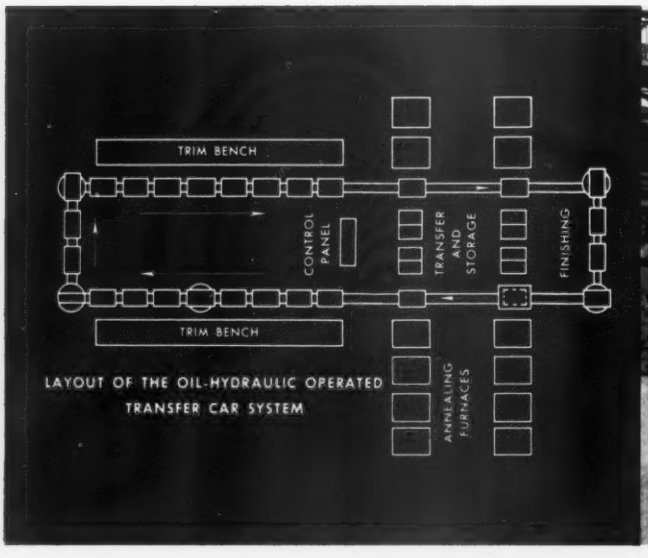

Transfer cars make a 600-foot circuit in moving from trim benches to annealing furnaces to finishing and back at National Malleable & Steel Castings Co., Cleveland, Ohio.

Transfer car on a turntable

27 shuttle cars, each capable of handling a 6-ton load, carry castings around this circuit at most efficient speed and with a minimum of manual labor. The system's successful operation during the past two-and-a-half years is evidence of the wise engineering employed and sturdiness of the construction.

Many limiting conditions led Jeffrey and National Malleable to decide upon hydraulic equipment and drives underground, in a tunnel below the car tracks. The ten pushers on the straight-line movements and the five 10-foot turntables are powered by individual hydraulic units. In operation, cars advance one space every five minutes and turntables rotate to receive and discharge the cars.

Jeffrey makes layouts of equipment and mechanizes complete foundries, or supplies individual pieces of equipment. Catalog 845 describes the services. The Jeffrey Manufacturing Company, Columbus 16, Ohio.

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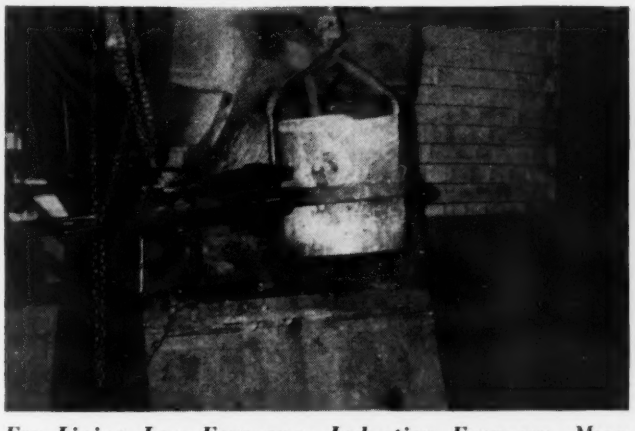
Rx for more melts-per-lining

Norton refractory cements are engineered and prescribed for longer, lower cost service across the range of furnace applications



For Lining Low Frequency Induction Furnaces. Many foundries melting nonferrous metals and malleable iron report that Norton ALUNDUM* fused alumina refractory cement provides extra long life. This high-melting, long-lasting cement is also prescribed for use in holding ladles, desulphurizing ladles and heat treating and sintering furnaces.

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The right Rx for you

Working with ALUNDUM, CRYSTOLON, MAGNORITE and Fused Stabilized Zirconia materials, Norton technicians will help you find the exact Rx's — *engineered and prescribed* refractories — you need for more efficient furnace operations. For details, see your Norton Refractories Engineer, or write to NORTON COMPANY, Refractories Division, 300 New Bond Street, Worcester 6, Mass. *Canadian Representative:* A. P. Green Fire Brick Co., Ltd., Toronto, Ontario.

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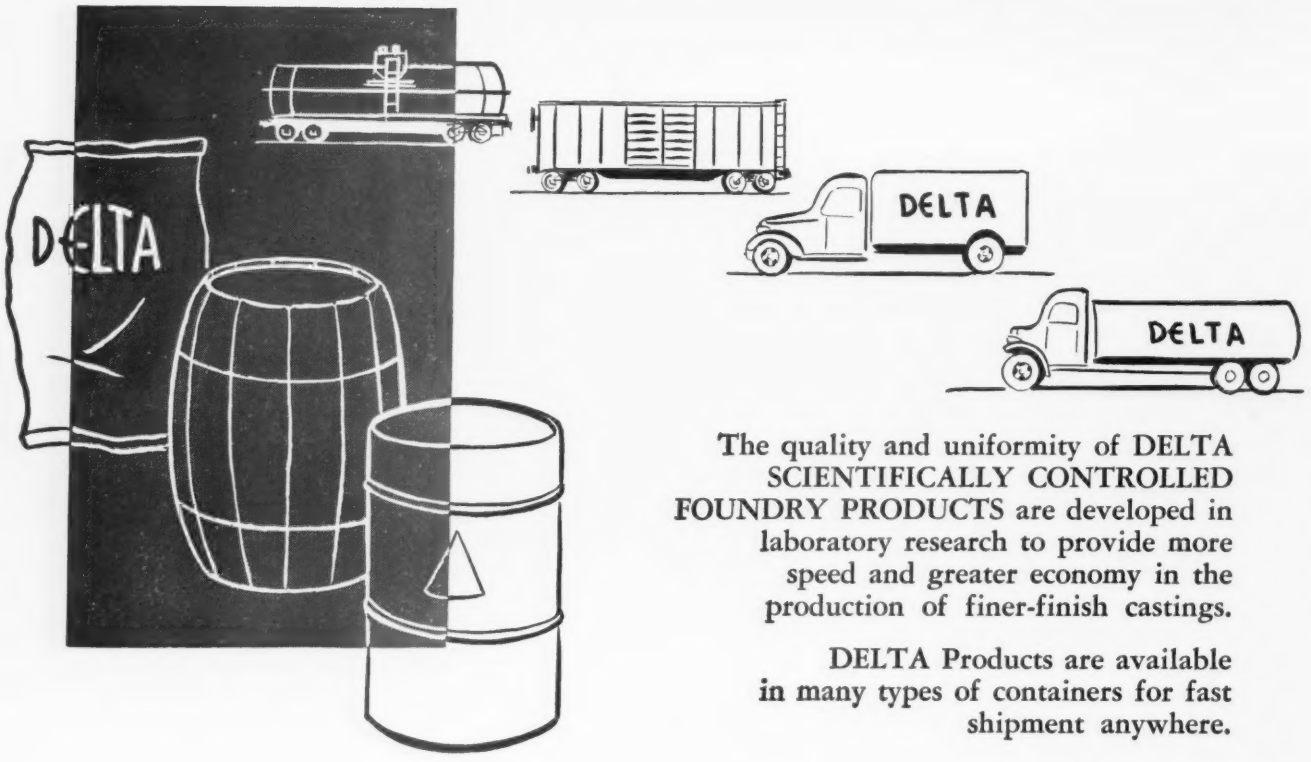

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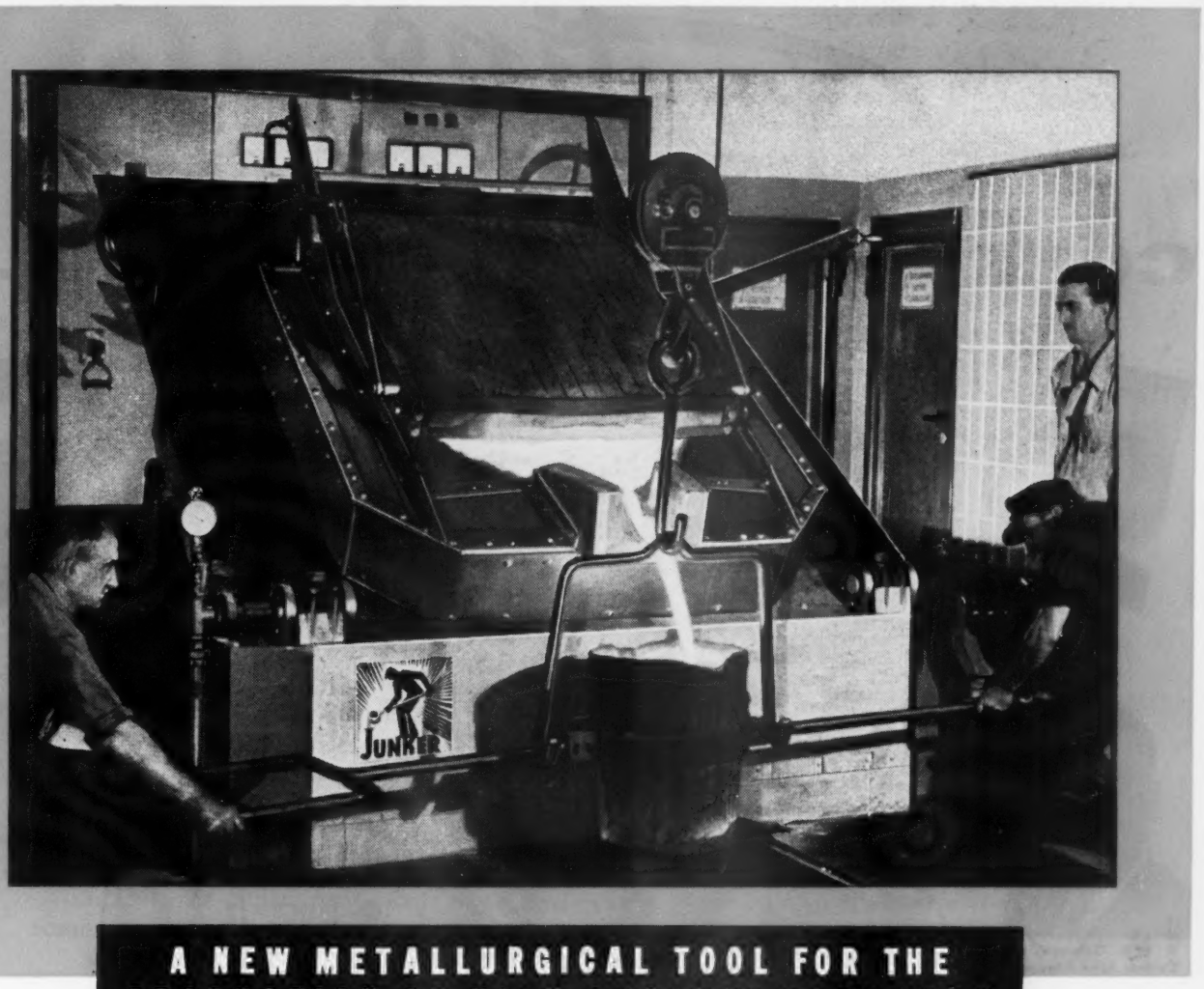

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The photograph shows a Junker coreless induction furnace for melting and superheating cast iron in a German foundry.

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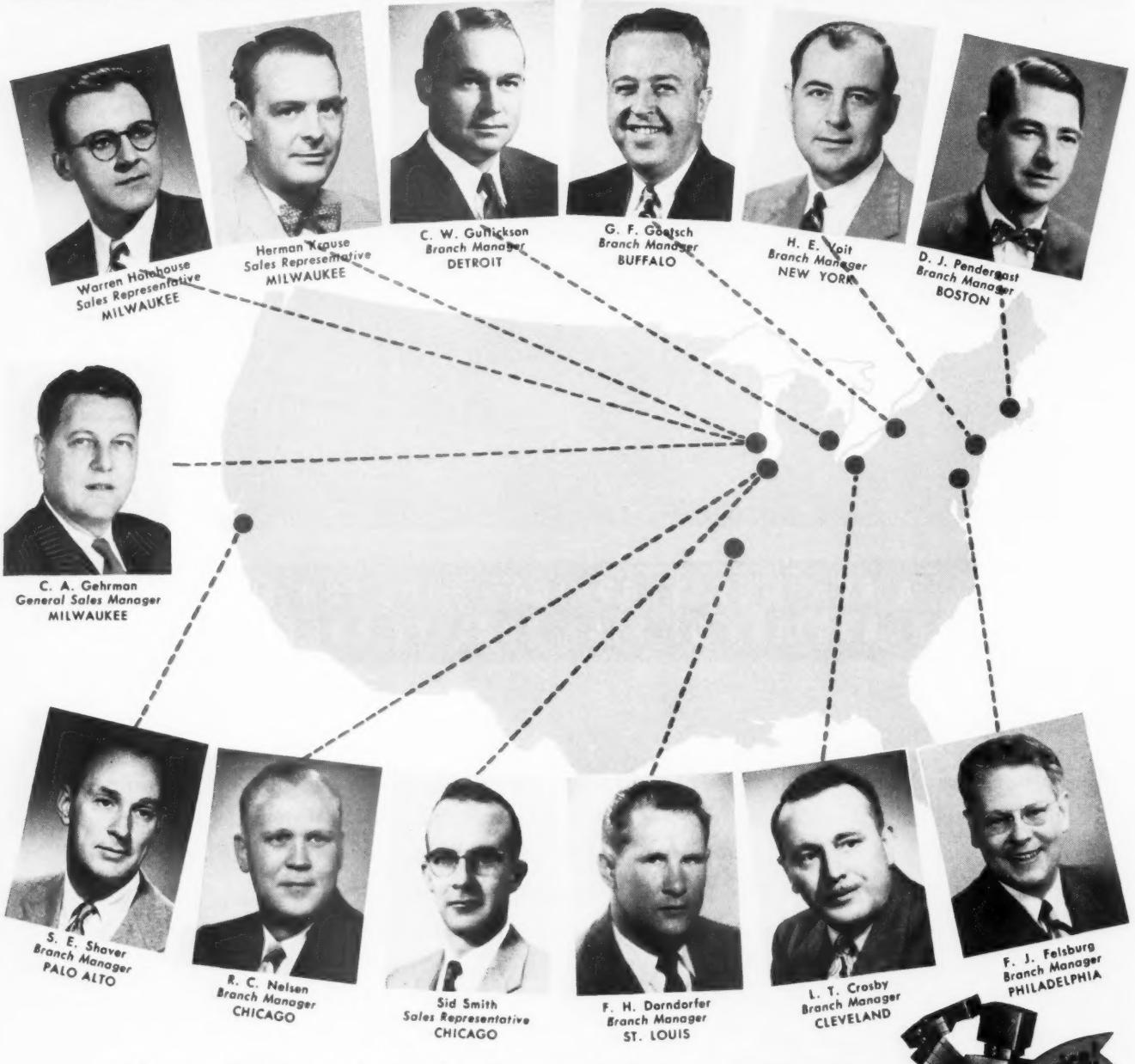

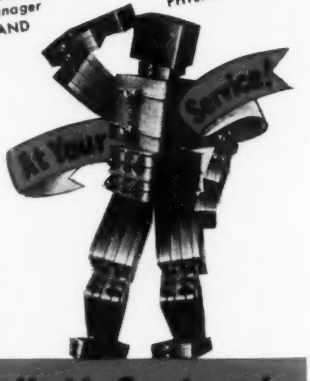

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It's That Time Again

The foundry industry has just completed one of its better years. While there were problems, some of which continue, business was good for most companies.

Naturally, many are interested in how the producers of castings can develop an even better record in 1956. Since this is the time of year when resolutions appear to be in order, foundry management might profitably make some of the following at the start of the new year:

1. I will utilize fully the vast amount of data on developments in practices and processes available through technical organizations and the business press, realizing that a successful operation cannot be built on tradition, prejudices or ignorance.
2. I will modernize my operations wherever possible, knowing that it is uneconomical to use worn-out or obsolete equipment.
3. I will demand that safety be practiced in the plant, will develop a live, forceful safety program and personally see that it is carried out.
4. I will insist that good housekeeping be practiced and will hold the management team strictly accountable for a clean and orderly foundry.
5. I will try to get more engineers in my organization and will pay more attention to training of both production and sales personnel.
6. I will undertake a program of enlarging the market for castings through conversion of components from other forms of fabrication to castings.
7. I will avoid unintelligent price cutting and pattern swapping simply to get orders.
8. I will have as my constant goal the production of better castings—castings that will meet completely the needs of the customers.
9. I will support the trade association in my field which serves industry in many ways, including market promotion.
10. Finally, I will have renewed confidence in the potentials of this basic industry which has served our civilization well in both peace and war, which has made tremendous strides in both practice and product during the past decade, and which can be an essential link in the metalworking field as we move toward the goal of a $500-billion economy.

Frank G. Steinebach
Editor

The Automotive

Turbine-powered automotive vehicles may be on the market in two years. Will you be ready to furnish the quality castings needed to meet turbine engine requirements and attract parts business to your foundry?

By ROBERT H. HERRMANN
Associate Editor

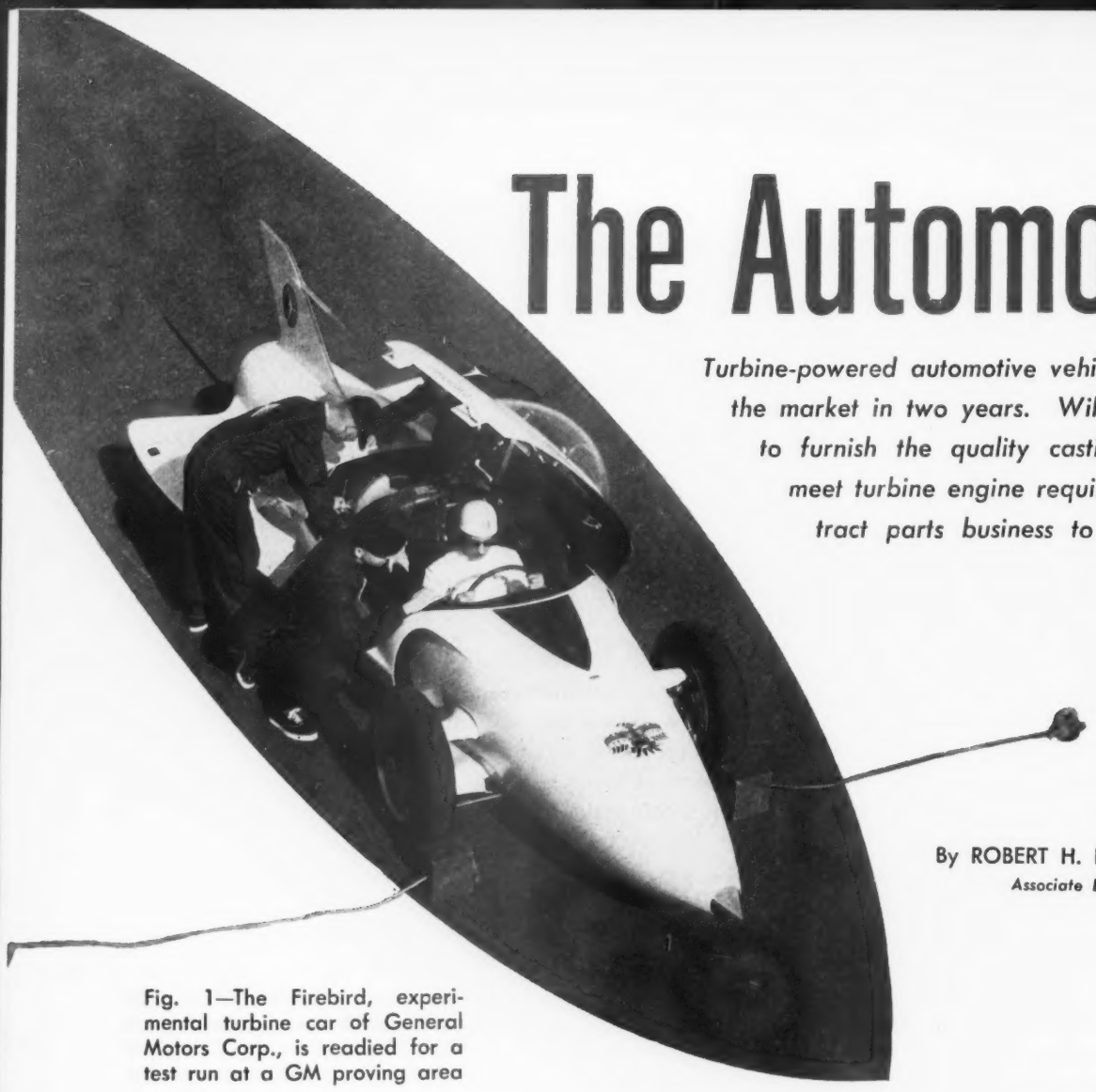


Fig. 1—The Firebird, experimental turbine car of General Motors Corp., is readied for a test run at a GM proving area

WHEN the gas turbine engine comes into widespread use for automotive vehicles the foundry industry will see many changes from current practices of producing parts for reciprocating engines. Tonnage will be reduced. Fewer cast parts will be required. Different alloys will be needed to meet a new set of requirements. Production emphasis will be shifted to different molding techniques—shell, investment, permanent mold and die casting.

In addition, foundries will continue to face keen competition from the forging and stamping industries. Forgings still occupy a prominent share of the turbine picture in the minds of some development engineers. Stampings are practically a must for many parts, particularly ductwork, which comprises a large part of the engine. Parts machined from solid metal are next to out because of cost.

One important fact, however, stands out. Engineers from Chrysler, Ford, General Motors, Studebaker-Packard and nonautomotive companies working on turbine engines would prefer to use castings in the production model of the engine. Casting is the most direct method from raw material to finished part. The potential is high for low cost parts. Strength requirements can be met.

But . . . turbine engineers say that foundrymen still cling to the age-old concept of selling tonnage instead of offering an engineered part. Time-worn practices prevent full application of advanced knowledge and new methods for quality improvement. They fear that foundries cannot produce, consistently, parts of the quality needed for service components even though current methods have the potential for turning out such quality. Engineers of other companies, however, say that castings made in jobbing shops have met and can meet all requirements for many turbine engine parts in mass production.

What Is a Gas Turbine Engine?—Basically it consists of a compressor turbine and a drive turbine mounted on a common shaft, which also serves as the power output shaft. Hot gases directed against the drive turbine turn the shaft and, consequently, the compressor which furnishes more air to the burner to develop more hot gases. Such an engine is called a single-shaft turbine, but its characteristics are unsuitable for use in an automotive vehicle.

A slightly more complicated engine, called a two-shaft turbine, has the necessary characteristics for automotive use. It has the compressor turbine and a drive turbine mounted on one shaft. A second

Gas Turbine— *A Challenge to Foundries*

General Motors Corp.

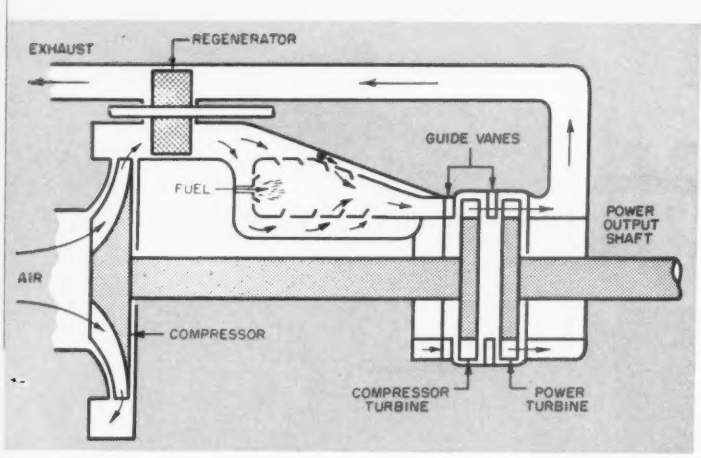
Fig. 2—Shown with GM's Firebird and the Turbocruiser bus at right are: W. A. Turunen, head of Gas Turbines Dept., at left and C. L. McCuen, retired vice president in charge of the styling staff, at the right

Ford Motor Co.

Fig. 3—The Mystere, a styling research car of Ford Motor Co., features sculptured rear fins, a rear compartment for a gas turbine or conventional engine

Chrysler Corp.

Fig. 4—A 1955 Plymouth sedan equipped with Chrysler's turbine has covered many miles on public roads during test runs



Ford Motor Co.

Fig. 5—Schematic plan of a two-turbine automotive engine with regenerator for fuel economy

drive turbine is mounted on a second shaft—the output shaft. There is no mechanical connection between the two shafts. Thus the engine is divided into two halves—the compressor section and the power output section. Each revolves at different speeds.

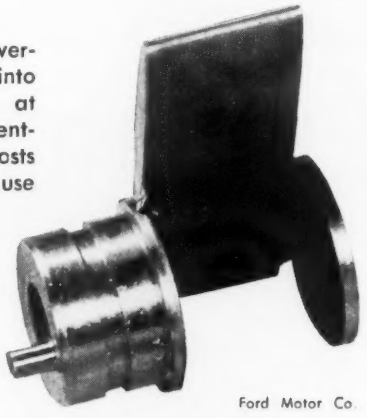
Outside air enters the engine through the compressor. It then passes through a regenerative heat exchanger—which recovers heat from exhaust gases—and into a burner. From the burner, gases at approximately 1500° F propel the turbine, which drives the compressor and accessories, then they propel the power turbine, which drives the car wheels, and finally are exhausted through the regenerator. Fig. 5 is a schematic drawing of a two-turbine engine.

In addition to the compressor and two drive turbines, other major automotive turbine engine parts are:

1. An air intake and compressor scroll unit.
2. A housing forming the back of the compressor scroll, a cover for the compressor shaft and bearing points for that shaft.
3. A circular duct and nozzle ring mounted at the rear of that housing for directing hot gases to the compressor drive turbine.
4. A similar assembly encircling the power output drive turbine and fastened to another housing with bearing points for the output shaft and for forming the reduction gear assembly case.
5. A regenerator for transferring heat from the exhaust to incoming air and a burner for further heating that air.
6. Accessory units similar to components used on current reciprocating engines.

The weight of such an engine, complete with accessories and ready for connection to the drive shaft of an automotive vehicle, has been estimated at one-half to two-thirds that of a reciprocating engine of the same performance. Current thinking is that the production turbine would be closer to half the weight or less. The V-8 engine used in one of the three most popular low cost cars weighs about 825 lb, including the automatic transmission. In rough figures, then, the turbine power plant would gross anywhere from 400 to 550 lb. Such an engine would have less than a fifth as many major moving parts as a piston engine of similar power.

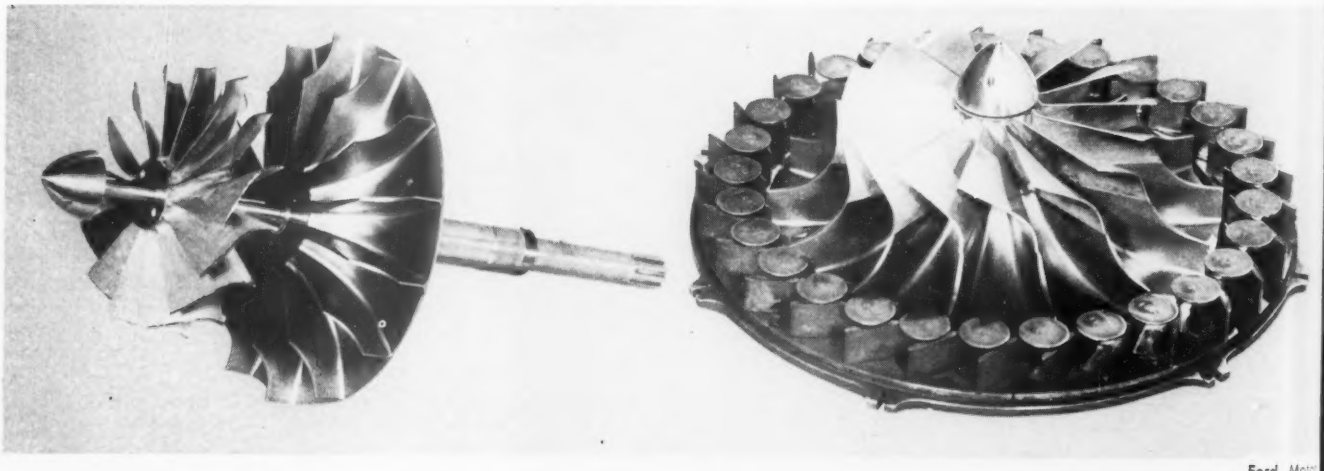
Fig. 6—Single nozzle, several of which are mounted into the compressor assembly at right below, is investment-cast. Engineers say it costs too much for production use



Ford Motor Co.

Fig. 7—Small vaned section of this compressor turbine is a permanent mold aluminum casting. The large vaned section is an aluminum forging

Fig. 8—Compressor turbine and variable nozzle assembly. The nozzles have been made movable to improve part load fuel economy of the engine



Ford Motor

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Fig. 9 (left)—Compressor air scroll and inlet side of the compressor housing

Fig. 10 (right)—Reverse side of compressor housing with bearing case attached

How Many Castings?—Estimates on the number of castings for the turbine engine cover a wide range. Total weight of castings and the metals which might be used, based on cast parts which now seem feasible, can be estimated more accurately and are given in the accompanying table.

Pounds	Metal	Part Description
50	Nodular iron	Housing
40	Nodular iron	Housing
35	Nodular iron	Housing
3	Aluminum	Compressor turbine
20	Aluminum	Compressor scroll assembly
1	Stainless steel	Compressor drive turbine blades
2	Stainless steel	Power output turbine
21	Stainless steel	Compressor nozzle ring
3	Stainless steel	Power turbine nozzle rings
15	Gray iron	Regenerator parts
10	Gray iron	Gear case extension
25	Miscellaneous castings	
225	total	

Estimated total weight of turbine engine castings is 225 lb. This does not include various accessories common on today's cars and an automatic transmission as planned by some manufacturers. A V-8 block weighs about 200 lb and the two heads weigh 120 lb. The total for these three parts is 320 lb, almost 100 lb more than all the turbine engine castings. Additional castings in a reciprocating engine include eight pistons, intake and exhaust manifolds, clutch housings, flywheel, various cooling system parts, and possibly rocker arms, valves, crankshafts, camshafts and other miscellaneous parts.

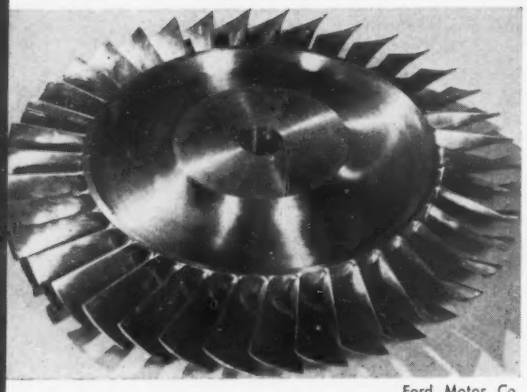
Only slight agreement exists among the various companies engaged in turbine engine development as to which parts will be cast and which parts might be either cast or forged. Also, different metals are being considered for similar parts in the various engines. In addition, some of the companies plan to use parts which other companies plan to eliminate. The major part in this category is an automatic transmission as opposed to a simple forward and reverse gear arrangement. There is universal agreement, however, that high-temperature-resistant sheet steel will be used for ductwork to carry the hot gases and for parts of the combustion chamber and regenerator.

Current thinking among automotive engineers concerning the major turbine engine parts follows:

Those at one company foresee that the compressor turbine will be a composite part as shown in Fig. 7. The smaller vaned section would be an aluminum permanent mold casting and the larger section an aluminum forging. Experiments with a one-piece compressor cast in 355 aluminum alloy indicate that the outer part of the casting does not withstand stresses build up by centrifugal forces. In this company's engine, compressor speeds go up to 35,000 rpm. Since the compressor is about 9½ in. in diam, the perimeter of the wheel exceeds the speed of sound at top rotational speed.

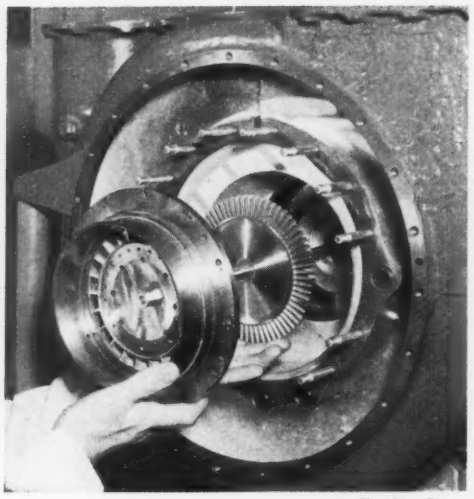
Certain magnesium alloys have been used successfully for one-piece cast compressors. Success is attributed to the better ductility of the magnesium alloys. The danger of fire, however, restricts the use of magnesium. If a rub occurred, fine magnesium powder and heat would be produced with possibly disastrous results.

Different Design Is All Cast—Another company, however, has had successful results with a one-piece investment cast aluminum compressor. In fact, the engineer in charge of turbine development commented that a successful compressor had been made over a year ago and that all problems concerning the part were considered solved. The blades and general shape of this compressor differ slightly from that shown in Fig. 7. The success of this design is significant because the compressor in this engine operates at a maximum of 51,500



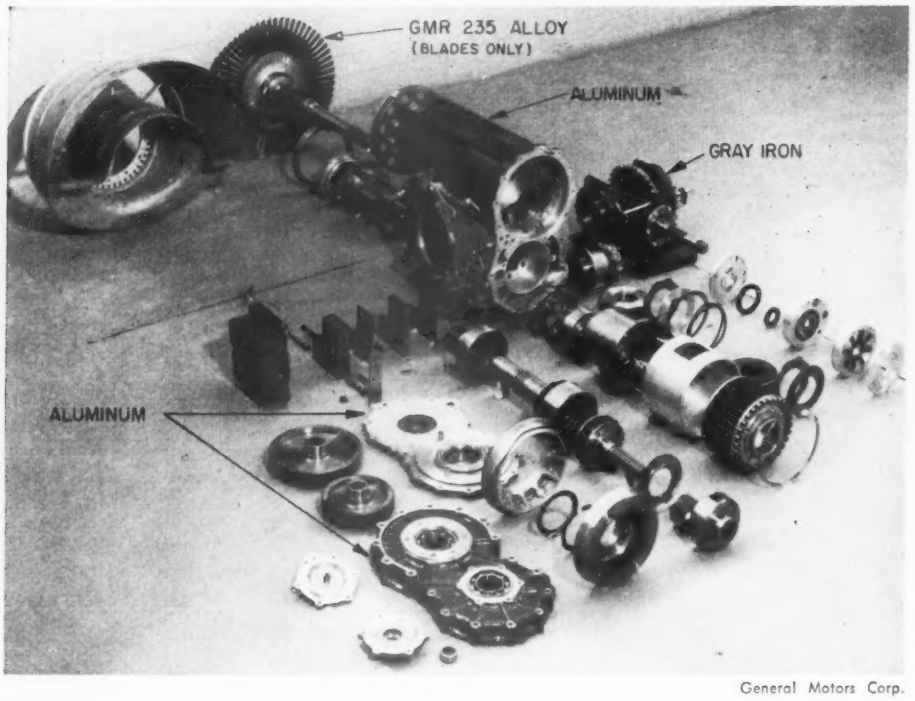
Ford Motor Co.

Fig. 11—Power output drive turbine is about 8 in. in diam. At present, blades are cast, the center forged

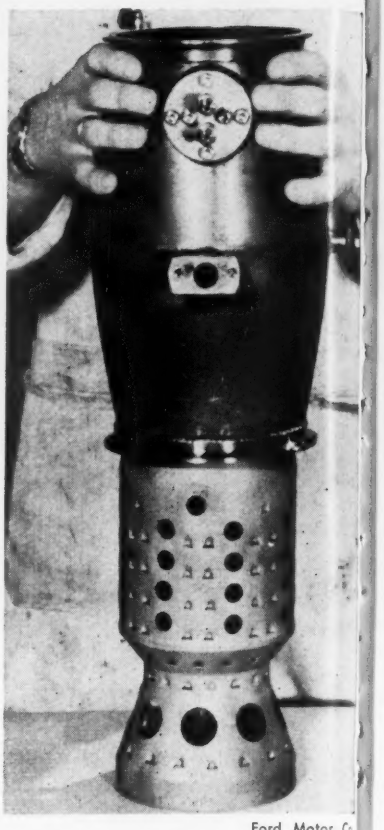


Chrysler Corp.

Fig. 12—Investment-cast nozzle ring shown in assembly in foreground directs gases against power turbine behind it



General Motors Corp.



Ford Motor Co

Fig. 13—This burner has a sheet metal liner and a welded housing. It heats incoming air employed to propel the two turbines

Fig. 14—Major cast parts and the metal used in the power section of the turbine engine installed in the GM Firebird are designated in view at left

rpm. Idling speed is 20,000 rpm.

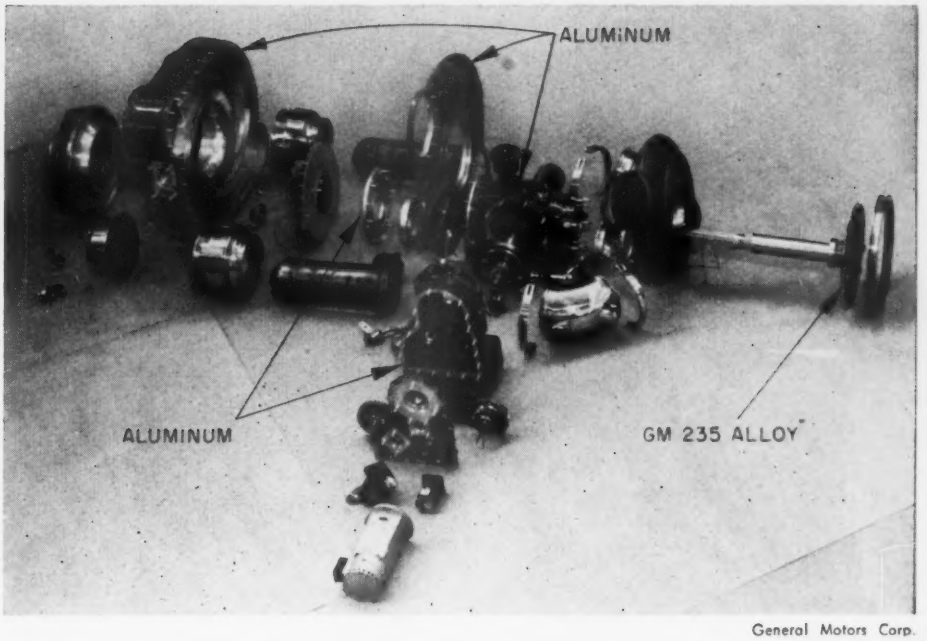
Fig. 8 shows a compressor and the variable area nozzle assembly. The nozzles are movable to improve part load fuel economy of the engine. A single nozzle from the assembly is shown in Fig. 6. The part is made of austenitic chrome steel alloy. An iron-aluminum alloy with aluminum content of 6 to 14 per cent also has been used with success. At present this is an investment casting, but its cost is too high and either the cost of the casting method must be reduced or the part must be redesigned. The turbine engineer for the company using these parts believes that an extruded wrought section might be used.

The cover plate at the inlet end of the compressor and the compressor scroll is shown in Fig. 9. Most engineers agree that these will be aluminum castings, probably made in shell molds or die cast. The reverse side of the compressor housing is shown in Fig. 10 with a nodular iron bearing case attached. It appears as the dark colored component. The bearing case currently being used on this company's engine differs from the one pictured. As it looks now, it is about 18 in. in diam at the end where the compressor scroll is attached, 8 to 9 in. in diam at the compressor drive turbine end, about 3 or 4 in. in diam between the two larger sections and about 10 in. long. The shaft between the compressor and compressor drive turbine passes through the connecting channel. The part is $\frac{1}{4}$-in. nodular iron with heavier bosses at the bearing points. Weight is about 50 lb.

Another, similar nodular iron casting, weighing about 40 lb, would house the reduction gear case and form the bearing case for the power output turbine. It would be about 6 in. in diam at the turbine end and about 11 in. long. One-quarter-inch nodular iron also would be used for the automatic

Chrysler Corp.

Fig. 15—Housing for another experimental burner has cast aluminum top, nodular iron bottom



General Motors Corp.

Fig. 16—Major castings in the compressor section of the Firebird engine are indicated here

transmission case. This would be about 5 in. square and 8 in. long and would weigh 30 to 35 lb. It is possible that this transmission case could be combined with the reduction gear case and bearing case for the power output turbine into a one-piece casting.

May Use Aluminum Instead—Another company which has cast the two bearing housings just discussed as one piece in gray iron and nodular iron is considering casting it of aluminum and protecting those sections subjected to high temperature with stainless sheet steel so mounted as to leave an air space between it and the housing. The cover for the main engine housing is cast aluminum. This company also is using a cast aluminum reduction gear housing, which probably also will house the simple forward and reverse gear transmission.

The transmission or reduction gear case extension which encases the power output shaft is similar to the comparable part on current piston engines. It could be made in gray iron as it is now or in aluminum. In either event, less than 10 lb is involved.

The turbine which drives the compressor is similar to the power output turbine shown in Fig. 11. The blades on the turbine shown are 1 to 1¼ in. long; on the compressor drive turbine they would be ½ to ⅝-in. long. The turbines in the engine of one of the companies are the same size—about 8 in. in diam. Each has about 40 blades.

The blades for both probably will be cast individually of 410 stainless steel in shell molds. The center section of the compressor drive turbine will be forged from 410 stainless with blades attached by welding or brazing. The power output turbine will be made by casting the blades into a lesser steel center section. Engineers at this company feel that a one-piece cast turbine does not appear promising at the moment. If casting quality could be improved, then a one-piece turbine cast in ferritic stainless steel would be possible for at least the power output turbine. It turns at a speed one-fourth slower than the compressor section and is subjected to temperatures of around 1325° F, or about 175° F less than the compressor drive turbine. Consequently, stresses are not as high as for the compressor drive turbine.

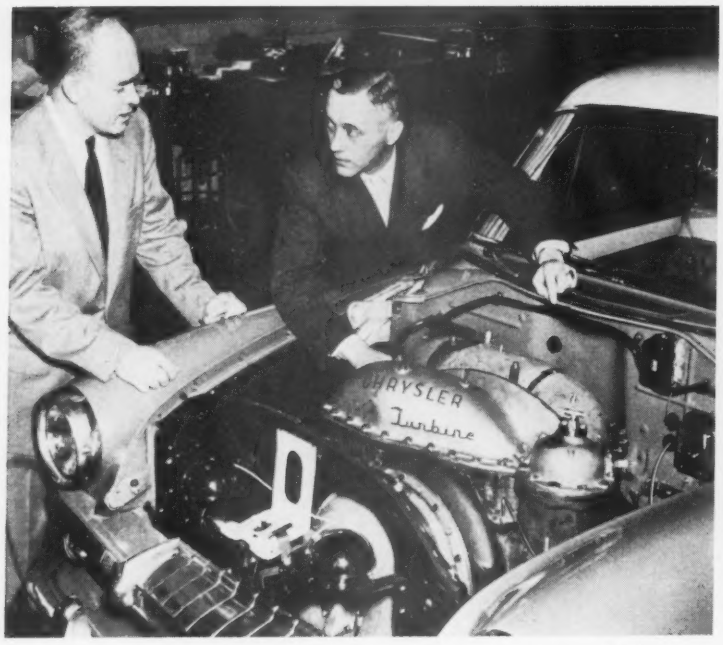
A Different Approach—At another company the compressor drive turbine is 6 in. in diam and the power output turbine is 7 in. in diam. The smaller turbine has about 60 blades, ⅝-in. long. There are nearly 70 blades, 1 in. long on the larger wheel.

The blades for both turbines are investment cast of cobalt-base alloy in a rim about ⅛-in. thick. The ring of blades then is welded by a newly developed process to a center wheel section forged from stainless steel with an analysis of 25 Ni, 16 Cr and 6 Mo. Each wheel has 28,000 psi tensile strength and weighs 1½ to 2 lb.

Two nozzle assemblies to direct the hot gases against the turbines at the proper angle are required for each engine. At one company these consist of investment cast rings each containing 20 blades. The material is a high-chrome stainless steel. A ring is shown mounted in the assembly held in the right hand of the man in Fig. 12. There is some thought of making the blades movable to increase engine efficiency and performance. If that is done, the blades would be cast individually and mounted in holder rings.

Another company has decided that the blades in its nozzle assemblies will be movable. The material will be either a 6 to 14 per cent aluminum-iron alloy or a straight chrome stainless steel.

Although most company engineers agree that the regenerative type heat exchanger probably will be mostly of heat-resistant sheet metal, the engineers at one company foresee the possible use

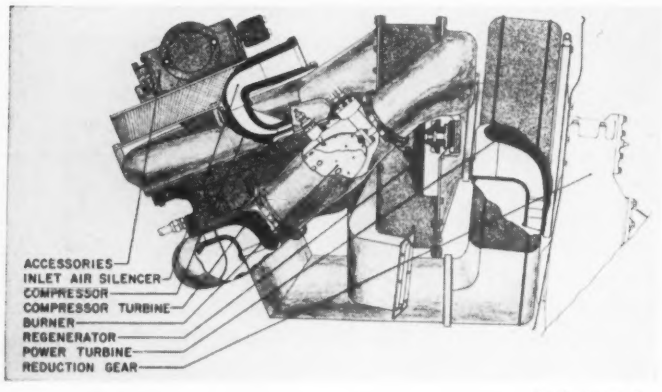


Chrysler Corp.

Fig. 17—W. I. Chapman, left, project engineer, and G. J. Huebner Jr., executive research engineer, inspect the Chrysler turbine in a Plymouth

Chrysler Corp.

Fig. 18—Bottom section of the Chrysler turbine can be viewed as it is lowered into the engine compartment of a production model Plymouth car



Ford Motor Co.

Fig. 19—The initial Ford automotive gas turbine

of 12 to 15 lb of gray iron castings.

Two representative burners are shown in Figs. 13 and 15. Basically, each burner consists of a liner and a housing. The liner probably will be a sheet metal part, and the housing could be of cast parts. Housing for the experimental burner in Fig. 13 is a weldment. An aluminum casting forms the housing cover for another burner, Fig. 15. Bottom part of cast housing is visible in Fig. 17.

Consensus among the engineers is that they would prefer to use castings where they can. They also would prefer to use aluminum except where heat resistance is necessary. They foresee that many of the castings will be poured in shell molds and a few in investment molds. Engineers of at least one company would prefer to make most of the parts as die castings to eliminate practically all machining and obtain cored-to-size holes.

When Will the Engine Come?—No one will stick his neck out and say, but there are many indications that it will be only a couple of years. Eight months ago all companies were forecasting 10 to 15 years. The official spokesman of one company still sticks to that estimate. Today, other companies are saying that the engine will be in production within 5 years. By saying "within" they could mean sooner.

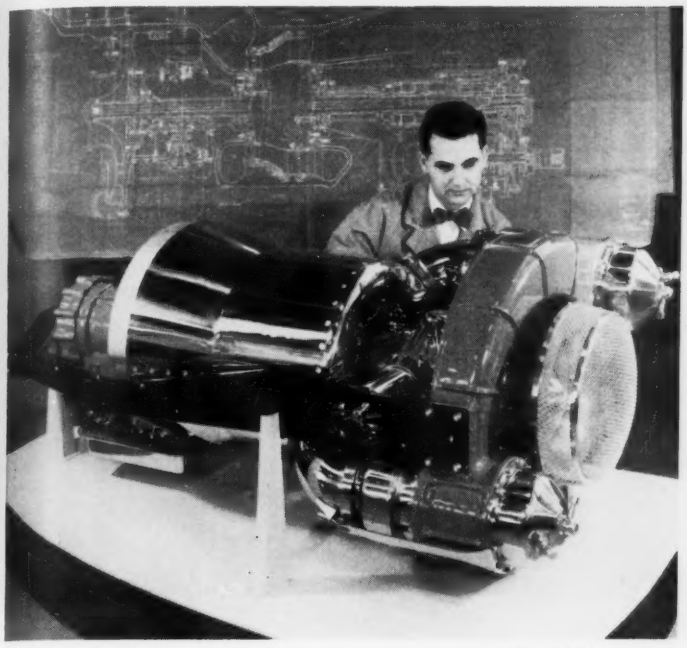
Production people at one company are working with design and other problems pertaining to mass production of turbine engine parts. One of the company's engineers says that in 2 years turbine blades will be mass produced in stacked shell molds just as rocker arms are now.

Another company reports "extremely satisfactory progress" on turbine development last year. The spokesman intimated that the progress was much more than had been expected and put their turbine project years ahead.

Many of the arguments raised against early use of the turbine in automotive vehicles have been answered by the companies' own research projects. Some of these objections are:

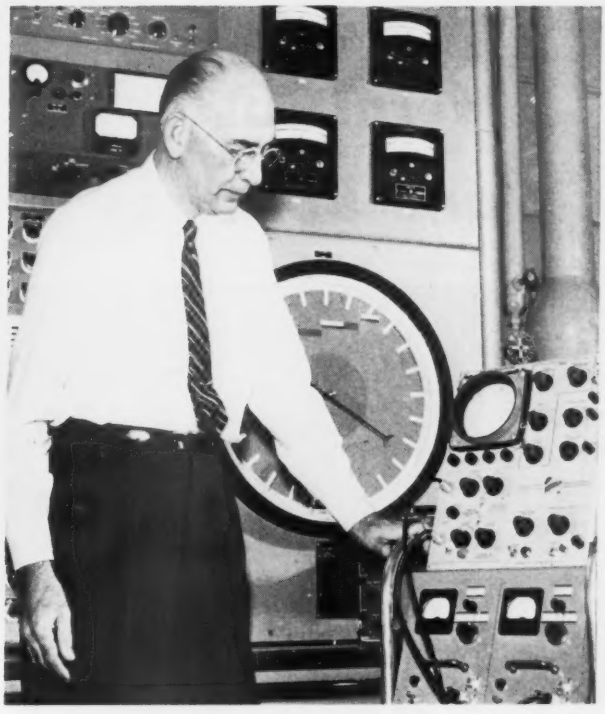
High operating temperature. Gases passing over the compressor drive turbine are at about 1500° F. Over the output turbine they are 1325° F, and into the regenerator they are 1150° F. Theoretically, metal parts in the path of these gases would be 200 to 300° F less. Operating experience with the engine, however, has shown that those temperatures are conservatively high. In spite of temperatures actually encountered, operating engines have posed no heat problems.

Heat-resistant alloys are too expensive and scarce. Many parts made of stainless steel sheet metal are planned. But some of the companies have successfully used aluminum-coated sheet metal with success, and its cost is lower than the stainless, and no scarce or expensive materials are



General Motors Corp.

Fig. 20—Complete twin burner gas turbine engine ready for installation in the Firebird chassis. Aluminum radiation shielding encloses hot parts



Ford Motor Co.

Fig. 21—A. A. Kucher, Ford Engineering Staff's Scientific Laboratory director, examines electronic equipment for turbine parts development

involved. Nickel and cobalt alloys have been used for cast and forged parts. But so have iron-aluminum alloys, and they contain no expensive or scarce materials. Heat resistance of these alloys is as good as the heat-resistant steels. Iron-chromium alloys also offer possibilities as do iron-aluminum-molybdenum alloys.

High stresses would cause parts failure. The company whose engine has the highest maximum operation speed of 51,500 rpm, about a year ago developed a cast aluminum compressor and drive turbine that operate satisfactorily.

Operating cost is too high. Test conducted by the company which has operated a turbine in a conventional passenger car chassis and body for the last 2 years show that fuel consumption is comparable with that of present reciprocating engines. In addition, the engine requires no bath of oil as the piston engine does.

Braking the car would be a problem. Although it is true that research models of the turbine engine provide no braking effect, one company sees current brakes and normal brake development as taking care of any requirements. Spokesman of another company commented that by operating the power section in one direction and the compressor section in the other direction and installing a coupling to join the two sections when power is reduced, the compressor section would develop braking power. A differential gas turbine developed by a nonautomotive company has the compressor and power sections joined through differential gears. This engine automatically gives braking power from the compressor section. Furthermore the engine is said to provide better part-load fuel economy, quicker acceleration, lower idling fuel consumption and a broader operating range than a standard two-section turbine.

Turbine would cost too much to produce. Since turbine engines use less than one-fifth as many parts as a piston engine and only a few of these parts require machining, it is hard to see why production cost would be higher than for a piston engine. True, some of the alloys being considered are expensive. But such alloys are needed only for some parts of the burner, regenerator and ductwork, plus the nozzles and in the compressor and output drive turbines. It would seem that the relatively high cost of these parts would be offset many times over by elimination of extensive machining required for the block, pistons, crankshaft, camshaft and other piston engine parts.

One engineer has said that today's piston engine is a challenge and a hope—a challenge that the turbine must be competitive in performance and production cost with the piston engine, and a hope that if a complicated device like the piston engine can be built as cheaply as it is, the turbine can be produced at lower cost. The paragraphs above indicate that cost may not be such a big problem. As to performance, an engineer from the company which is operating a turbine-driven passenger car says that its fuel economy equals that of conventional automobile engines, its exhaust is cooler, and its performance is far beyond that of piston engines of comparable horsepower.

This same engineer also commented that development of the turbine engine to its present state of efficiency required less than 10 years, and that in its present state of development, its performance rivals that of piston engines which have 50 years of refinement and improvement behind them.

By HARRY ST. JOHN
Foundry Consultant

Metal Losses and Balances in

The Brass Foundry

The sixth article in Mr. St. John's series points out that foundry profit depends importantly upon maintaining the highest possible proportion of good, finished castings while holding net metal losses to a minimum figure

THE brass foundry has its metal stock room in which metal is stored until such time as it is made up into melting charges and sent to the furnaces. From that point on the metal runs a sort of gantlet until finally a portion of it reaches the ultimate consumer in the form of finished and acceptable castings. Along the way both loss and salvage occur.

A substantial amount of the metal shipped out by the metal room becomes gates and sprues, pigs, pickings, scrap castings and machine turnings, and finds its way back for reuse. The foundry's profit depends to an important extent upon maintaining the highest possible proportion of good finished castings while net metal losses are held to a minimum and temporary losses are salvaged as efficiently as possible. Self-evident as all this may seem, one finds an astonishing difference between foundries in what may be termed their metal balances, a difference which inevitably reflects itself in the profit and loss statement.

In the accompanying tabulation (Table I) a comparison is made between two entirely mythical foundries. Individual items have been taken from actual experience in various foundries but in each case the total is a composite exhibiting an extreme of poor practice for Foundry X, and extreme of good practice for Foundry Y. The comparison is intended to illustrate the importance of the differences shown so that any foundryman can grade the performance of his own plant in accordance with his own facts and figures. If he finds information lacking at any point, the need for remedying such lack will become evident. One hundred pounds of metal is taken as a convenient basis since it permits direct conversion into percentages.

The final comparison may seem fantastic, but actually is close to the mark if we remember that these are extremes. Foundries with best practice will approximate the top figure shown.

The disparity in cost per pound of castings will not be quite so great. For example, Foundry X will not spend as much to snag grind 41.8 pounds of castings as will Foundry Y to grind 62.3 pounds. Let us assume that the two foundries have the same wage rates, the same burden rates and are equally efficient in their use of labor and equipment with the exception of the differences shown in the tabulation. Everything else being equal it will be found that Foundry Y produces castings some 30 to 35 per cent more cheaply than Foundry X.

If we analyze the differences step by step, it should be possible to discover how so wide a difference can exist and what measures should be taken to bring the metal balance in line with the figures shown for Foundry Y.

A. Non-Metallics in Charge—We have to suppose that Foundry Y has done a complete job of cleaning up its foundry returns, gates, sprues, scrap castings and turnings, a matter which has been discussed in a previous article (FOUNDRY, September 1955, p. 154). In certain respects such a cleaning is necessary to insure high metal quality. The one exception pertains to molding sand which clings to gates and sprues. The removal of sand is not essential but is advisable if the cost can be justified. If not removed one needs to remember that it *is* sand, not metal.

B. Melting Loss—The melting loss listed for Foundry Y is one-half of 1 per cent, a figure which can be equalled or bettered slightly when melting red brass or bronze in a well operated electric foundry. The loss for higher zinc alloys may run

as much as 1 per cent. The eight per cent loss assigned to Foundry X is probably even less than that experienced by some foundries but is definitely higher than it needs to be. From 1½ to 4 per cent, depending upon the furnace type used, is attainable with the red alloys in most fuel-fired furnaces. Higher figures are usually the result of feeding the heat to the metal too fast or of excessive superheat. Rapid melting has cost advantages. Whether it pays off in any given case is for the foundryman to decide.

In order to judge the operation of his furnaces the foundryman needs to know what his melting loss actually is. Determination of the loss is not a simple matter. Analysis of the melt to determine how much zinc must be added to compensate for loss is not a satisfactory method. The loss is by no means limited to zinc. The other components of the alloy are less subject to volatilization but all are readily oxidizable. Only to a very slight extent are the oxides recovered by deoxidation after melting. Nor is it proper to

Table I—How Metal Balances Vary

	Foundry X	Foundry Y
Metal charged to melting department	**100.00**	**100.0**
A. Nonmetallics in charge	0.5	0.0
Metal available for melting	**99.5**	**100.0**
B. Melting loss	8.0	0.5
Metal poured from furnaces	**91.5**	**99.5**
C. Skim and spill	2.0	1.0
Metal available for pour	**89.5**	**98.5**
D. Pouring Loss	0.5	0.5
E. Cold metal pigged	5.0	2.0
Metal poured into molds	**84.0**	**96.0**
F. Gates and sprues	42.0	33.6
Rough castings	**42.0**	**62.4**
G. Sand blasting	0.2	0.1
Clean rough castings	**41.8**	**62.3**
H. Grinding loss	(4.2)	(1.2)
Finished rough castings	**41.8**	**62.3**
I. Scrap (rejects)	3.3	1.2
Good rough castings	**38.5**	**61.1**
J. Machine turnings	7.7	6.1
Finished castings	**30.8**	**55.0**
K. Scrap (rejects)	3.3	1.2
Good finished castings	**27.5**	**53.8**

make a metal balance at the end of the year and charge the discrepancy to melting loss. There are other losses, some of which may be even more serious.

The only reasonably accurate method of measuring metal loss is to weigh the metal into and out of the furnace. This is practically a laboratory job which has to be done under unfavorable conditions. There are two possible procedures. One involves pouring an entire heat into pigs which are later weighed. The other requires that the metal from the furnace be weighed molten, in crucible or ladle. In either case the metal charged into the furnace must be clean, free from any appreciable weight of nonmetallics which would tend to falsify the loss figure.

If the metal is to be poured into pigs, a space of concrete floor near the furnace should be swept clean. Here the brass is to be skimmed and poured into the ingot molds. The molds should be in good condition with no cracks. Skimmings and spill, including any spill at the furnace itself, should be carefully swept up and cleaned in a ball mill with water, then screened and dried. The difference in weight between the furnace charge and the pigs plus clean metal from spill and skimmings, represents the melting loss *plus* the loss during pouring. At least five or six heats should be run to determine a fair average. If results from heat to heat agree closely, the competency of the test is established.

If a crucible is used for melting, it is well to start the test with a new crucible. With any hearth-type furnace, a new lining should *not* be used since it will absorb some metal, particularly lead and zinc. The lining should, however, be in good condition, free from low spots which may trap metal, and should preferably have been used for melting the same alloy which is to be tested. It will be necessary to drain the furnace as completely as possible at the end of each heat.

The test involving the weighing of molten metal has the advantage that the metal after weighing can be poured into castings. A portable platform scale, with platform protected by a sheet of transite may be employed. The crucible or ladle with its shank is weighed empty, filled with metal and then, after skimming, is weighed again. Metal in the skimmings and furnace spill is cleaned and weighed as described previously. The test should be continued for several consecutive heats, preferably at least two days. No attempt need be made to measure the loss on each individual heat, and it is not necessary to drain the furnace completely until the end of the final heat. The accuracy of all scales used should be checked carefully.

The first method described is more precise, but the second is less costly and more convenient. Weighing molten metal also has the advantage that the pouring loss is avoided. If both procedures are followed, the difference in results will be a fair measure of the pouring loss.

C. Skim and Spill—When the crucible or ladle is skimmed, some metal unavoidably goes with the skimmings. There is always some spill when pouring from a furnace into a ladle and more when metal is poured into the molds. The 2 pounds listed for Foundry X is not an unusual figure, possibly a bit conservative. Foundry Y's 1 pound per hundred-weight is difficult to attain but worth trying for. No matter how efficient salvage methods may be, not all of the metal in the skim and spill is recovered. The unrecovered portion becomes part of the foundry's net loss. If the percentage of recovery is the same, Foundry X's net loss will be twice that of Foundry Y. Careful handling of the metal is the only cure.

D. Pouring Loss—Pouring loss is meant to include only the loss of metal by oxidation and volatilization during the pouring operation. This is, of course, another net loss since no recovery is possible. There is no good reason why pouring loss should differ from one foundry to another, and the figure given is known to be fairly typical. However, if castings are so designed or

gated as to require an excessively high pouring temperature, the loss will be high.

E. Pigging Cold Metal—As the pouring of a crucible or ladle nears the end, the last of the metal often becomes too cold for successful pouring into molds. Sometimes this can be avoided or the metal can be salvaged, molten, for the next pour; otherwise it must be pigged for remelting. Pigging must naturally be kept to a minimum for the sake of the casting yield. Best practice in this respect has been discussed in a previous article. (See FOUNDRY, December 1955, p. 90.)

F. Gates, Sprues and Risers—While extravagant gating does not involve a net loss, it can and often does reduce the casting yield very seriously. In Foundry X it is assumed that 50 per cent of the metal poured into the mold is nonproductive, i.e., is used for gates, sprues and risers. In Foundry Y the nonproductive metal amounts to only 35 per cent, a figure which can be reached or even improved upon if the character and design of the castings are favorable. Admittedly there is certain to be a considerable variation in casting yield depending not only upon the size and shape of the casting but also upon the composition of the alloy used. The high-strength brasses, such as manganese bronze, and some of the high-nickel alloys require heavier gates and risers than do the red alloys. With these alloys substantial savings can sometimes be made by the use of exothermic riser compounds and insulating sleeves.

It sometimes happens that foundry management dictates a change from a red alloy to one containing a higher percentage of zinc, in order to reduce the initial cost of the metal. The detrimental effect of this change on casting yield is apt to be overlooked. It is true that if the red metal castings were over-gated in the first place, no alteration of gate sizes may be needed when the change to yellow metal is made. In that case only an opportunity has been lost.

Efficient gating and risering is too large a subject to be considered in detail here. It will be discussed more fully in a future article.

G. Blasting—A small unavoidable loss occurs when castings are cleaned by blasting, and it is a net loss. It is assumed that Foundry X uses sand while Foundry Y uses steel or malleable shot. The peening action of the latter compares favorably with the cutting action of sand. Copper shot, although very expensive at present, has advantages which are likely to promote its future use.

H. Grinding Loss—Variation in grinding technique has no influence on casting yield, since the metal ground away is nonproductive and has already been discounted as such. It does have a pronounced effect on net loss of metal and also upon the labor cost of the grinding operation. In Foundry X the weight of metal removed by grinding amounts to 10 per cent of the rough-casting weight, in Foundry Y only 2 per cent. This includes snag grinding of stub ends of gates and removal of fins and core caps. Good molding practice will avoid most of the fins and caps. Snag grinding can be minimized by laying out the pattern so that cutting of the casting from the gate can be done close to the casting by an abrasive cutting wheel or thin saw. It is often possible to cut so closely that almost no grinding is necessary. Obviously overgating will increase the grinding cost and loss.

The recovery from grindings is so meager, dollarwise, that the writer feels justified in considering them a 75 per cent net loss. On this basis. Foundry X has added 3.2 per cent of the melt to its net loss, Foundry Y 0.9 per cent.

I. Rough Casting Scrap—Foundry X is listed as having 8 per cent rough-casting scrap, Foundry Y 2 per cent. Both of these figures are exceptional, but both have been observed by the writer in actual foundries. The effect of this difference on casting yield and over-all cost needs little comment. The causes of scrap are so many and so diverse that no attempt will be made to discuss them at this time other than to say that brass foundry scrap can be controlled only by a systematic statistical approach. An exception perhaps should be made for a foundry so small that one man with a retentive memory is able to watch the making of every casting from start to finish. And then only if the variety during the course of a year is small. A later article will be devoted to the subject of scrap.

From this point on the captive foundry has some advantage over the jobbing foundry. Its castings are machined nearby, where the results can be observed at first hand, and it is possible to obtain the co-operation of both product designer and machine shop superintendent. The importance of this will appear presently.

J. Machine Turnings—It probably does not happen too frequently that machine turnings amount to 20 per cent of the rough-casting weight, as listed for Foundry X, but it can happen. On several occasions, the writer has noted individual castings where the proportion of turnings was as high as 50 per cent, usually where the casting was intended to serve more than one purpose. The 10 per cent listed for Foundry Y is not exceptionally low. The cure lies in a co-operative study of the finished casting by foundryman, designing engineer and machine shop supervisor to determine how closely the dimensions of the rough casting can be made to conform to the desired finished dimensions. The idea that scrap can be avoided by cutting deeply to remove surface imperfections is in general a fallacy. If the cost of excessive machining is applied to ways and means for avoiding the imperfections in the first place, money will be saved and the casting yield improved. In the red brasses and bronzes particularly the outer layers of the casting are most dense. To machine them away exposes the more open structure of the center section, thereby making leaks in pressure castings more likely.

K. Scrap Castings: Machine Shop Rejects — Again foundry X has been allotted 8 per cent of its rough castings as rejects which, after machining, are found to have foundry defects. The figure listed for Foundry Y is 2 per cent. Rejects after machining are apt to run about the same percentage as rough-casting rejects, although if attention is concentrated on these hidden defects, the machine rejects can be reduced to a lower level. It is evident that machine rejects represent a greater money loss than rough-casting rejects because of the additional work expended on them. The captive foundry has to absorb this loss as part of its operating cost. As a rule, the jobbing foundry must only accept the bad castings as returned defectives, while the customer stands the machining cost. However, it is obvious that the foundry's reputation will suffer and business will be lost if the customer finds a high total of defective castings.

The comparison in the tabulation is a measure of the casting yield only. It represents extremes between which most foundries will find themselves. However, there are a few foundries actually operating at these extremes. Table II completes the picture by giving a comparison of the net metal loss experienced by Foundry X and Foundry Y.

The net loss figures are based on the weight of metal delivered to the furnaces for melting. If the weight of purchased metal were to be used as a basis, the loss figures would appear to be much higher and would be so variable as to make a useful comparison of foundry performance impossible.

If the validity of a 2 per cent loss is questioned, the writer wishes to state that in a foundry with which he was at one time connected, the overall net annual loss for two consecutive years was 1.75 per cent. The bulk of the alloys melted at this time contained 81 per cent copper and 7 per cent zinc, balance lead, tin and nickel. Melting and pouring losses would be somewhat higher with increased percentages of zinc.

Table II—Net Metal Loss

	Per Cent Net Loss Foundry X	Foundry Y
B. Melting loss	8.0	0.5
*C. Skim and spill	0.2	0.1
D. Pouring loss	0.5	0.5
G. Sand blasting	0.2	0.1
*H. Grinding loss	3.2	0.9
Total Net loss	**12.1**	**2.1**

*It is estimated that 90 per cent of the value of metal in skimmings and spillings can be recovered. This is possible only if the foundry makes its own recovery and reuses the metal. If the waste material is sold to a smelter, the weight recovery may be even higher but the dollar loss will probably be greater. Only about 25 per cent recovery can be allowed for grindings.

The figures given in this article apply most closely to alloys containing not less than 75 per cent copper nor more than 15 per cent zinc, and to castings requiring from 10 to 20 pounds of metal per mold. Variations in alloy and in casting size would affect the figures but would not change the principles involved. It is apparent that we have here an area of foundry practice well worth careful study by the cost-conscious foundryman.

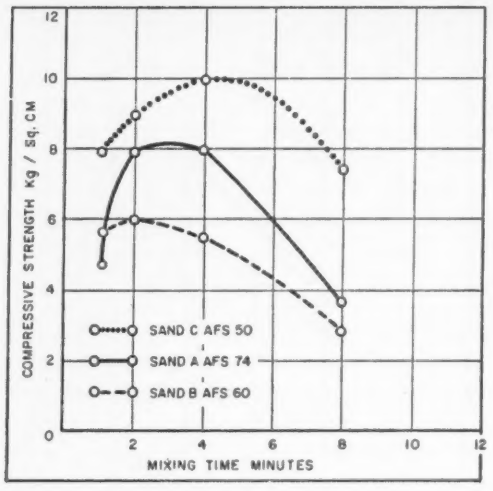


Fig. 1—How the extent of mixing time influences the compressive strength of CO_2 sands[1]

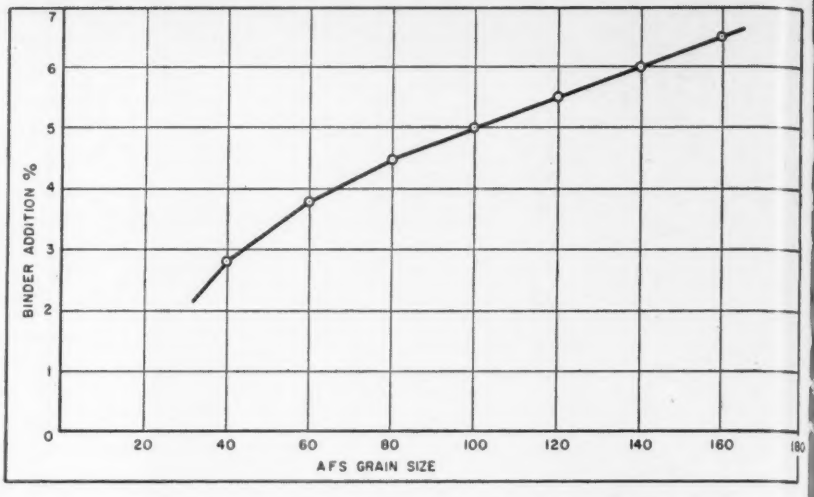


Fig. 2—Relation between the binder addition and sand grain size to reach maximum strength[2]

Recent Developments in

THE CO_2 PROCESS

Results of studies of thermal conductivity, gas evolution, collapsibility and reuse of sand bonded by carbon-dioxide gas are discussed

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Bochum Steelworks, Bochum, Germany

SOME four years ago the first reports were published on the CO_2 core and mold hardening process. Although the process originated in foundry practice, science and research have begun to clarify problems connected with it.

Thus Rolf Ziegler and Gerhard Hammer, Austrian Foundry Institute, Leoben, report in "Research on the CO_2 Process" on the influence of mixing time and percentage of binder on the strength characteristics of sands hardened with CO_2.[1] Fig. 1 illustrates their data on the influence of mixing time on compressive strength with three different sands.

The curves show that compressive strength increases with mixing time to a maximum, then falls off. Best results were obtained with mixing times of 2 to 4 minutes. These experiments were made with a laboratory mixer. Evidently it would be good practice to run a series of tests to determine the best mixing time whenever a change of sand or binder is contemplated.

The CO_2 process also has made good progress in English foundries, as D. V. Atterton reported in a paper read before the Institute of British Foundrymen.[2] A particularly interesting feature of this paper is the result of the study of the influence of grain size on the percentage of binder required for the attainment of maximum strength.

Fig. 2, from this paper, shows that increasing fineness calls for an increased percentage of binder to attain maximum strength. The silica sands most popular in Germany have an AFS fineness of 50 to 60 and develop maximum strength with 4 per cent binder. If fine chamotte is added to the sand, as it often is in steel foundries, more binder must be used to attain maximum strength. The required increase depends on the amount of chamotte in the mixture.

Thermal Conductivity—A number of factors have been studied relating to the CO_2 process, but to date the thermal conductivity of sands hardened with CO_2 has been neglected. To determine thermal conductivity, three cores about 50 mm in diam were inserted in a cylinder about 250 mm in diam, as shown in Fig. 3. The cores consisted of the following: 1. A synthetic silica-bentonite sand; 2. A special steel core mix of chamotte, quartzite and graphite, baked at 500° C; and 3. Silica sand with 5 per cent special binder containing water glass, subsequently hardened with CO_2.

The cylinder was rammed up gated from below so that the steel could rise in the mold. The intention was to have all three cores surrounded by

Fig. 3—Test arrangement of cores in studying the thermal conductivity of CO_2-hardened sand

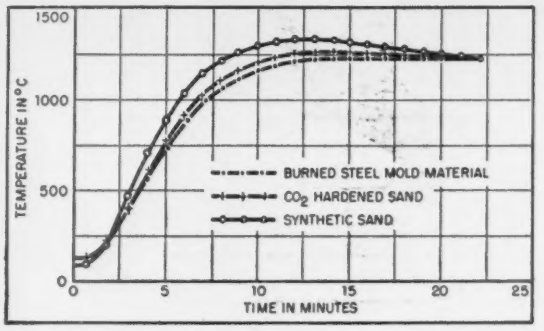

Fig. 4—Tests indicate that baked cores and CO_2-hardened cores increase in temperature at a slower rate than does synthetic sand

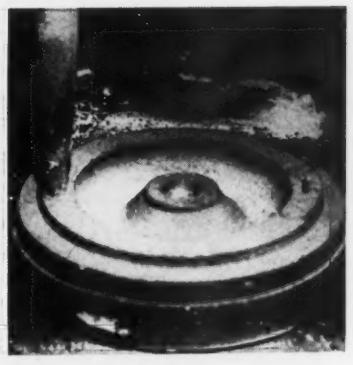

Fig. 5 (left)—Three risers used originally on this flywheel casting were reduced to one (Fig. 6, right) by means of the CO_2 process

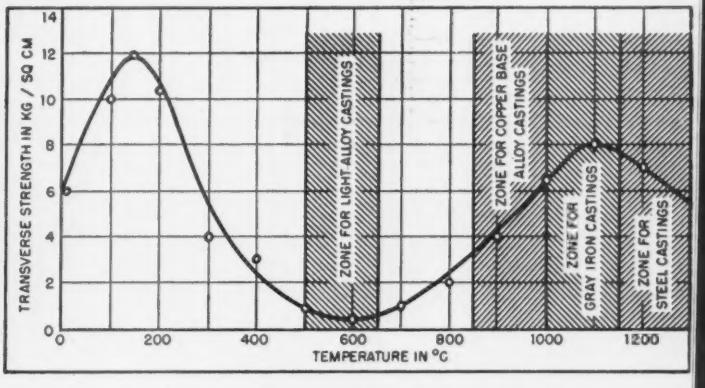

Fig. 7—Showing how transverse strength of CO_2-hardened sand varies with temperature

liquid steel at the same rate. Thermocouples of platinum and platinum-rhodium were installed in the cores, care being taken that the warm junction was at the same level in all cores — about 50 mm above the lower edge of the cylinder.

The mold was filled with unalloyed steel at about 1460° C (measured optically, uncorrected), and the temperature rise in the interior of the cores, as measured by the thermocouples, was read at 15-second intervals. The results of this experiment are shown in Fig. 4. Thermal conductivity of the synthetic sand appeared to be extraordinarily good; the baked core and the CO_2 core showed the same lesser rate of increase in temperature. Thermal conductivity must be approximately alike in both of these sands, but lower than in synthetic sand.

This lesser conductivity led to a change in the method of producing flywheels in a foundry on the lower Rhine. To avoid shrinkage of cavities in the hub, these parts had been provided with three risers, as shown in Fig. 5. After introduction of the CO_2 process, the same flywheels were cast with but one riser (Fig. 6).

Omitting two risers reduced the weight of the metal poured by over 35 lb. Since the rate of production is 1700 per month, the metal saving totals over 30 tons of iron per month. Furthermore, the molds do not swell, as they did with the former sand molds, so that the new process also shows a considerable reduction in machining costs.

Collapsibility — All studies dealing with the strength of sands hardened with CO_2 at different temperatures coincide in the characteristic of the resulting curves. Although the percentage of binders and other additives may change this characteristic to some degree, it nevertheless is certain that the strength figures are so low in the region of the melting temperatures of the light metals that good collapsibility is attained without special additives (Fig. 7). In the region of the melting temperatures of heavy metals, good collapsibility becomes a problem.

It should be remembered that sand temperature is 100 to 200° lower than melting temperature. If sand temperatures of around 1000° C are reached, however, as with gray and malleable iron, strength of the sand again has reached a maximum, and good collapsibility cannot be attained with a mixture of only silica sand and a binder based on water glass. In the region of the pouring temperature of steel, strength of the sand falls off so that cores sometimes collapse without special additives.

Fig. 8 shows the influence of sand strength at 1000° C on the cleaning time of a gray iron gear

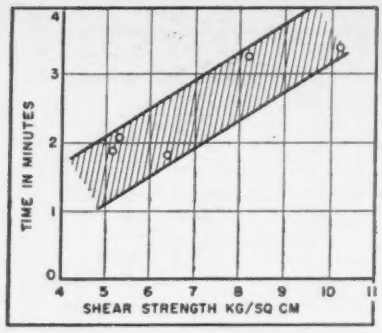

Fig. 8—Influence of sand strength at 1000°C on cleaning time of a gray iron gear housing

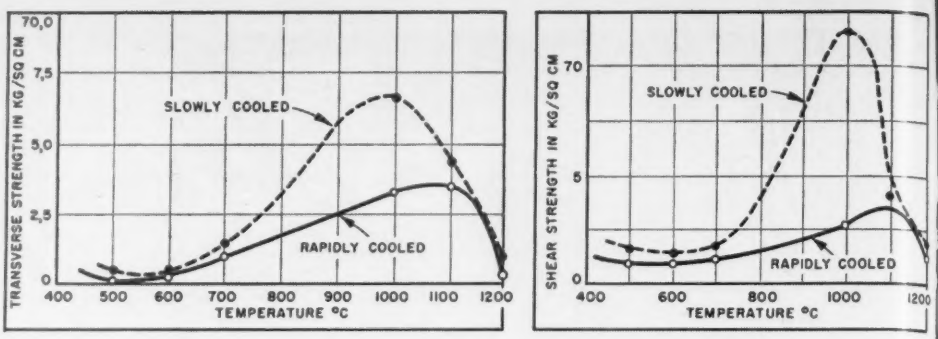

Fig. 9—Indicating the relationship of cooling speed to transverse strength (left) and shear strength (right) of CO_2-hardened sand

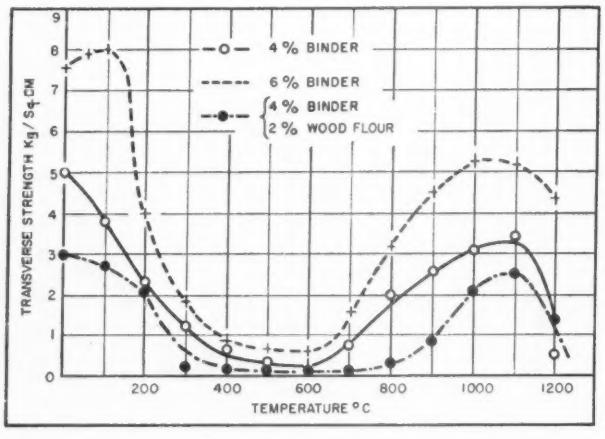

Fig. 10—Showing the influence of binder percentage on sand strength at high temperatures

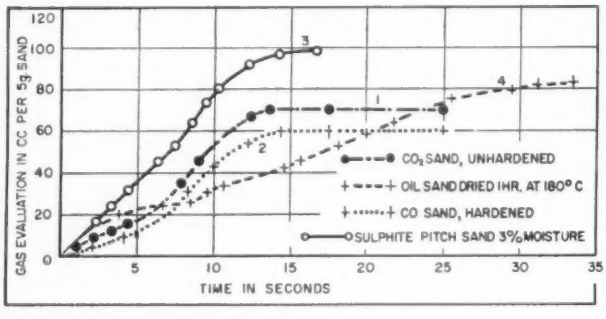
GAS EVALUATION IN CC PER 5g SAND
CO₂ SAND, UNHARDENED
OIL SAND DRIED 1HR. AT 180° C
CO SAND, HARDENED
SULPHITE PITCH SAND 3% MOISTURE
TIME IN SECONDS

Fig. 11—Illustrating amount of gas evolution of CO_2-hardened sand and other types of sand

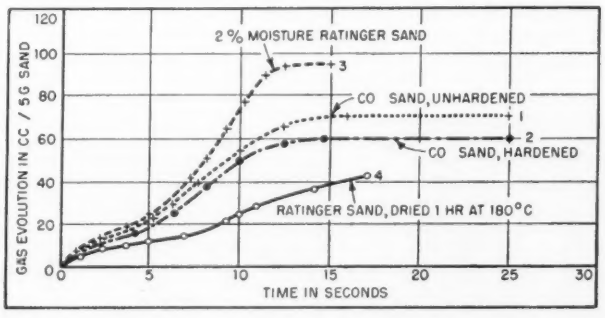
2 % MOISTURE RATINGER SAND
CO SAND, UNHARDENED
CO SAND, HARDENED
RATINGER SAND, DRIED 1 HR AT 180°C
GAS EVOLUTION IN CC / 5G SAND
TIME IN SECONDS

Fig. 12—Gas evolution of a bank sand is reduced after being dried for an hour at 180°C

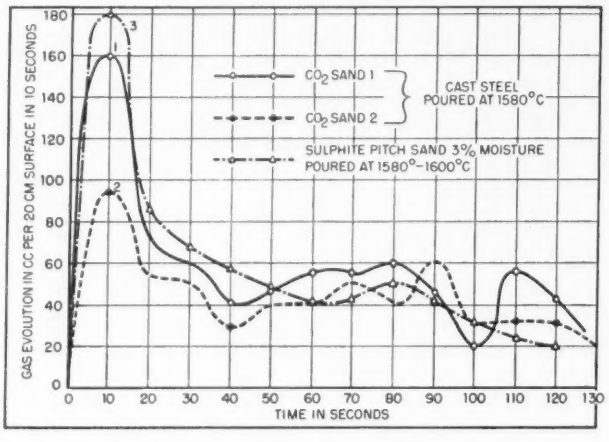
CO₂ SAND 1
CO₂ SAND 2
CAST STEEL POURED AT 1580°C
SULPHITE PITCH SAND 3% MOISTURE POURED AT 1580°-1600°C
GAS EVOLUTION IN CC PER 20 CM SURFACE IN 10 SECONDS
TIME IN SECONDS

Fig. 13—Amount of gas evolution of various sands after molds were poured at 1580-1600°C

housing. The addition of special additives to promote collapsibility — such as asphalt, seacoal and other organic substances — makes it possible to lower the strength of the sand at that temperature. Reducing sand strength by use of proper additives therefore also reduces cleaning time.

Another way of increasing core collapsibility is illustrated in Fig. 9a and 9b. In a laboratory oven, test cores of CO_2 sand were cooled alternately slowly and rapidly from the temperatures indicated. For rapid cooling, the test cores were taken out of the oven; for slow cooling, room temperature was attained in 24 hours. The diagrams show that in the high-temperature range, the strength values are considerably lower after rapid cooling than after slow cooling. These results indicate that castings made with CO_2 cores should be cooled as rapidly as is practical to take advantage of the reduced cleaning time made possible by lowered sand strength.

Earlier studies reiterated constantly that increasing the percentage of binder increases the strength of CO_2-hardened sands at room temperature. As we have seen, cleaning time is dependent on the strength of the sand at higher temperatures. A further study determined the influence of binder percentage on strength at high temperatures. Fig. 10 shows the result of this series of experiments. It follows that at high temperatures, increasing the binder increases the strength. To get good collapsibility and shorter cleaning time, it consequently is necessary not to use too high a percent-

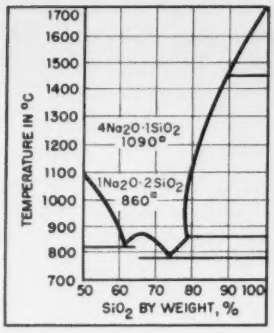

Fig. 14—Sodium oxide-silicon dioxide diagram

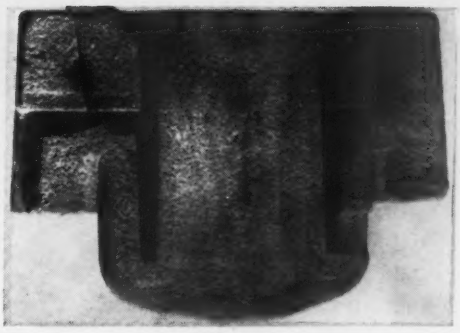

Fig. 16 (left)—Mold for a bell is assembled from CO_2-hardened cores. Completed casting (Fig. 17) is at right

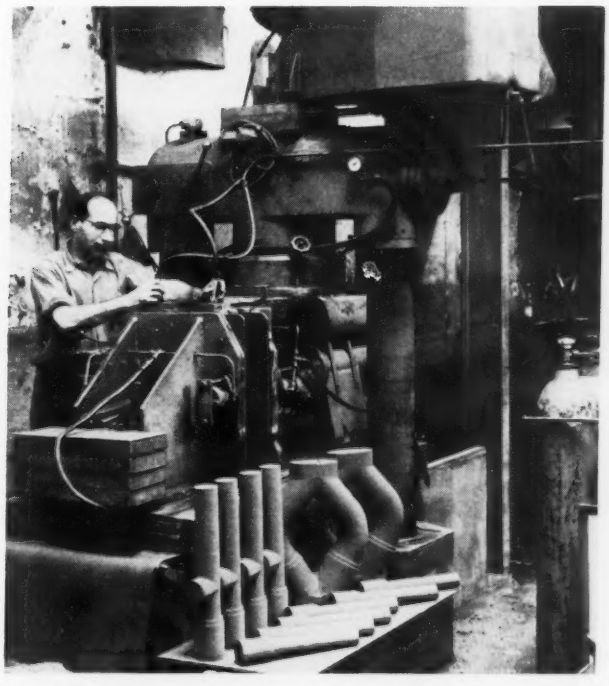

Fig. 15—Cores being blown here have a mixture containing 60 per cent used CO_2 sand

age of binder in the formulation of sand.

Further possibilities exist for improving core collapse with other additives. It already has been pointed out that wood flour has a favorable influence on cleaning time. One of the curves in Fig. 10 shows the result of these studies. An addition of 2 per cent wood flour reduces sand strength at high temperatures and makes possible accelerated core collapse.

Results of these studies agree completely with observations by P. Nicolas, who likewise determined that wood flour reduces hot strength, although his observations apply to synthetic sand.[3] Nicolas concluded that to reduce thermal expansion, such additives as wood flour, pitch or anthracite dust are required. He believes that to avoid slag patches, it is necessary to reduce hot strength of sand by proper additives, which incidentally reduce thermal expansion. A properly prepared CO_2 sand fulfills these requirements completely.

To secure a good core collapse, particularly in gray iron, these precautions therefore seem necessary:

1. Use of not too fine a sand, so that amount of binder need not be over 4 per cent.
2. No increase in binder beyond that required for the attainment of maximum strength, as determined in advance.
3. Cooling castings as rapidly as may be done without cracks.
4. Adding wood flour or other collapsibility accelerators, most of which are based on organic substances.

Gas Evolution—Attempts to develop a dry binder for the CO_2 process have not been entirely successful to date, and at present some water is introduced into dry sand by the liquid binder. The binder presently used, based on water glass, contains about 25 per cent water; adding 4 per cent binder therefore increases moisture in the sand 1 per cent. This water is, however, bound to the silica gel as water of crystallization or hydration and therefore cannot be driven out of the sand at the normal vaporization temperatures of water. Since organic binders likewise develop gas at pouring temperatures, it is important to determine the amount of gas developed with the CO_2 process compared with traditional molding practice.

Research required to determine this point was undertaken with the assistance of Prof. Dr. Roesch, Bergische Stahlindustrie, Remscheid. He had made studies of a similar nature about two years ago, and the apparatus used for his experiments was available for the present study.[4] Results are illustrated in Figs. 11 and 12.

Sand 1 in Fig. 11 consists of 50 parts of silica sand of 50 AFS fineness, 50 parts of chamotte of 0-1 mm grain size, 5 parts of special water-glass binder, and ½-part asphalt binder. Sand 2 is the same sand after CO_2 hardening. Experiments were conducted at 1100° C. Sands hardened with CO_2 develop less gas than a sand prepared with sulphite solution and 3 per cent moisture (sand 3, Fig. 11) and less than an oil sand dried for about an hour at 180° C (sand 4, Fig. 11).

Sands 1 and 2 in Fig. 12 are the same as 1 and 2 in Fig. 11, except for a further addition of ½ per cent iron oxide. Sand 1 is unhardened sand, and sand 2 is hardened with CO_2. The amount of gas

developed at 1100° C was exactly the same as sands 1 and 2 in Fig. 11. Both unhardened and hardened sand developed about the same amount of gas; gas evolution was considerably less than that of a Ratingen bank sand of about 2 per cent moisture (sand 3, Fig. 12). The amount of gas developed is, however, more than that developed by a Ratingen sand dried for an hour at 180°C (sand 4, Fig. 12).

In his work on the evolution of gas on the surface of molds, Roesch suggested setting up a gas-evolution ratio for various foundry sands which also would be a quality index. According to him, this quality index should be the permeability after six jolts divided by the gas evolution in 10 seconds. If this ratio is applied to sand hardened with CO_2, we get, with a permeability of 300 and gas evolution of 20 cc per cc of molding sand in 10 seconds, a ratio of about 15.

According to Roesch, this value is a good average, somewhere between the indexes for sands with low permeability combined with high gas evolution (for example, natural sands with sulphite solution and oil sands) and mold materials with low gas evolution and good permeability (such as dry sand molds). Up to this point the amount of gas measured was compared to the weight of sand in the mold. Fig. 13 shows cubic centimeters of gas in 10 seconds per 20 sq cm of surface.

The procedure used in these experiments, likewise with the assistance of Prof. Dr. Roesch, was to pour steel at 1580°C into the mold of a plate rammed up in the sand to be investigated. The gases were trapped in a burette, and changes from second to second were recorded by a flim-strip camera. As had already been determined, the greatest evolution of gas takes place during the first 10 seconds after pouring. For comparison, the curve for a sand with sulphite solution (sand 3) is plotted in Fig. 13. The evolution of gas by a sand hardened with CO_2 is not as great as that of a sand containing sulphite solution. Furthermore, we can conclude, as Roesch had previously observed, that organic binders form more gas than is formed in moist green sand free of organic binders.

Sand 1 was the same mixture as sands 1 and 2 in Figs. 11 and 12. Sand 2, however, was prepared without the asphalt binder, and gas evolution was reduced considerably. Composition of the gas developed in CO_2 sand was determined to be 31.2 per cent CO_2 and 21.5 per cent CO. The sample was sand 1, which contained asphalt binder. We may add in passing that in normal semisynthetic sands, the percentage of CO is considerably higher than that of CO_2.

Reuse of Used Sand—It follows from the composition of the vented gases that at high temperatures CO_2 is liberated, presumably by dissociation of sodium carbonate, which is formed in the reaction used in this process. After the samples are cast, we may be sure that at least at the boundary zone of the cores, sodium oxide will be formed. In considering reuse of the sand, we need to know what percentage of sodium oxide is the limiting one.

Let us examine the Na_2O-SiO_2 diagram in Fig. 14. We find that small percentages of Na_2O have

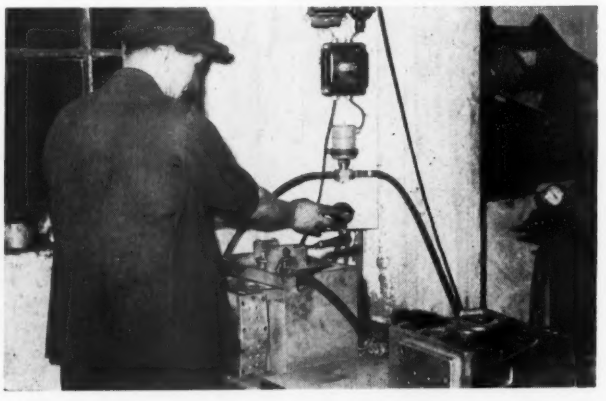

Fig. 19—Time relay which automatically regulates application of the carbon-dioxide gas

Fig. 18—Corebox for a water-jacket core (left). Difficulty in blowing was overcome by CO_2 hardening. Complete core at right

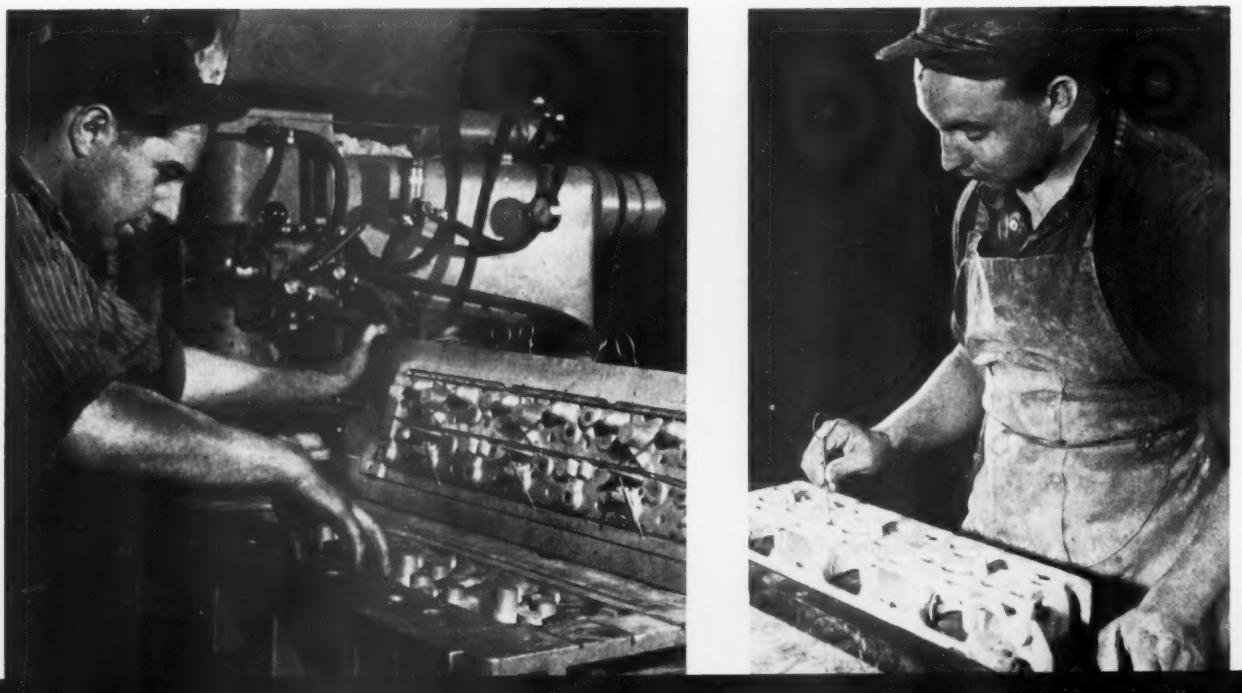

Fig. 20—This pit mold for a steel casting weighing 16 tons used CO_2-hardened cores

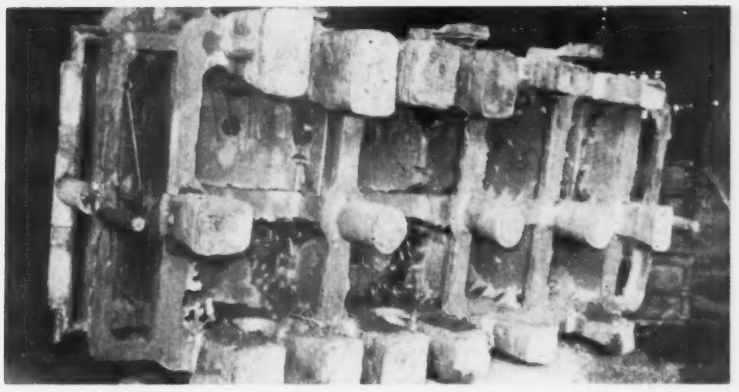

Fig. 21—Casting made in mold shown in Fig. 20. Cleaning and coremaking were simplified

no influence whatever on a reduction of the fusion point of silicic acid, although over 5 per cent causes an observable lowering. In synthetic sands, occlusion of the pores by excessive fines requires freshening the sand from time to time by adding new sand to preserve strength and permeability. CO_2 sands require similar freshening. It is possible to reuse the sand, if required at all, provided its foundry properties are checked continually.

In American foundries, it is customary to introduce fresh sand to the heap through the medium of the cores. It is possible to imagine, therefore, that in foundries with automatic sand handling and conditioning it may be possible to introduce CO_2 sand as core sand in place of new sand and in this way to do away entirely with additions of new sand. Extensive observations in a major German gray iron foundry, in which CO_2-hardened core sand was used continuously to freshen synthetic sands, showed a soda content in the heap of 0.04 to 0.25 per cent. Observations were made over the course of six months. It was found that the strength characteristics of the sand did not suffer during this period.

An example of the reuse of used CO_2 sand in making cores is given in Fig. 15. The sand is prepared from 60 per cent used CO_2 sand and 40 per cent fresh sand. Binder is about 3 to 3½ per cent. The cores are blown, and the working cycle, including gassing with CO_2, is about 50 seconds. Since the cores are extraordinarily strong, the use of reinforcing rods has been discontinued.

Practical Applications—Here are some recently developed instances of CO_2 hardening applications:

German foundrymen can produce castings with great accuracy with the new process, as Fig. 16 shows. The mold for a bell weighing 6 lb is assembled completely from blown cores hardened with CO_2. Sprue and gate are in the core. Fig. 17 shows the completed casting.

A particularly interesting example of making cores by the CO_2 process is shown in Fig. 18. Cylinder heads normally are made with split cores for the water jacket, a method which frequently causes flash at the juncture of the core halves. To avoid this flash, it was intended in the case under study to make the water-jacket core in one piece. The corebox for this core consists of about 20 sections. All attempts to make the core in a blower were at first unsuccessful. Even though particularly flowable mixes filled all the ramifications of the core, the green strength of these mixes was so low that the weaker sections collapsed when the loose pieces were removed.

Since introduction of the CO_2 process, however, it has become economically feasible to blow this complicated water-jacket core. Production time for this core by hand, including all processes from assembling the corebox to finishing the baled core, formerly was 150 minutes. The new method requires but 35 minutes. The illustration shows the complete core, which has received a surface hardening spray treatment with a core coating developed particularly for the CO_2 process to prevent damage of the surface in handling. This additional measure has reduced core rejects to a very small percentage.

To determine the economy of the process, it is necessary to know how much CO_2 is needed per core. To reduce this amount to a minimum, a German gray iron foundry developed a time relay for introducing the CO_2 (Fig. 19). The relay is started by a pushbutton, which opens a solenoid valve. The valve closes automatically after the previously set time.

That the CO_2 process is applicable to very large castings may be seen from Fig. 20, which shows the mold for a 16-ton steel casting. This piece was rammed up in the pit, with CO_2 cores both outside and inside, and was poured from two sides with two ladles. It is believed this is the largest casting made to date entirely by the CO_2 process. Fig. 21 shows the casting in the cleaning shop. In the making of this casting, 20 per cent of coremaking time and 30 per cent of cleaning time were saved. The saving is substantial in view of the great amount of total labor for this piece.

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Modern Facilities Incorporated in

New British Foundry

By VINCENT DELPORT
European Manager

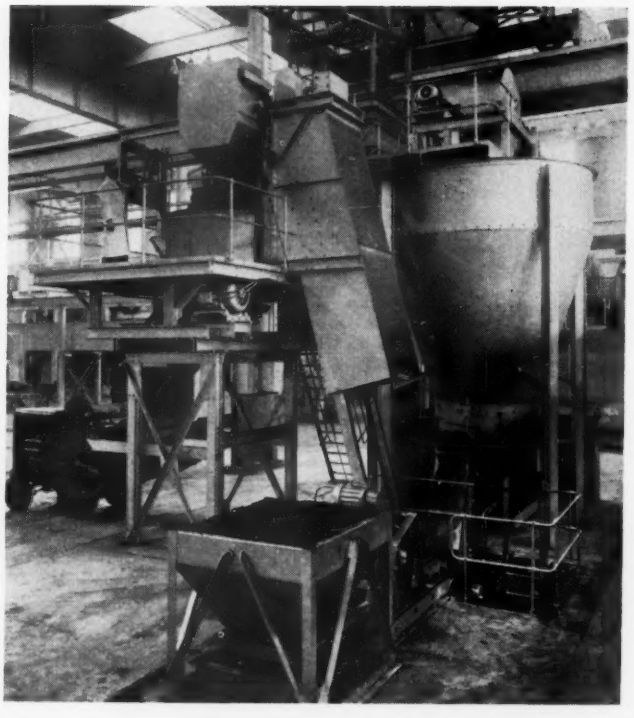


Fig. 1—New sand and riddled used sand are weighed into a loading skip, which raises the mixture into mill shown here

IN 1795, a foundry was built in a suburb of Birmingham, England, by Matthew Boulton and James Watt for the manufacture of their steam engines. Known as the Soho foundry, it was well designed for the times, and part of the original passages in the basement still exist. One hundred years later, in 1895, this famous old foundry came on the market, and in June of that year it was bought by W. & T. Avery Ltd. This firm, established in Birmingham more than 200 years ago, always has specialized in the manufacture of scales and weighing and testing machines.

In 1835, an American, Thaddeus Fairbanks, sold a patent for a new weighing machine to Henry Pooley & Son, a firm which in 1913 became incorporated with Avery. Henry Pooley was licensed to manufacture scales incorporating this patent. The patent in Britain was challenged in 1845 and was annulled, having been inadequately protected by the agents sent over for the purpose. The Fairbanks design was taken up in 1850 by the brothers William and Thomas Avery, who then proceeded to manufacture under license.

During the last 60 years the Soho foundry underwent many changes to keep abreast of modern developments. Space limitations compelled the company to acquire additional premises, however, and to plan a complete reorganization of its foundries. It was decided to build an entirely new foundry, taking advantage of the latest developments in technical efficiency and continuing the tradition established by its fine history.

A site covering 122 acres was acquired at Tame Bridge, near Walsall, in the vicinity of Birmingham. Ground was broken on July 26, 1951, and three years later the new $3,500,000 gray iron foundry started operations. The conception and planning of this foundry was largely the work of A. J. Shore, general superintendent of the foundries of W. & T. Avery Ltd., and of his associates. It was planned to produce 240 tons of castings per week, with a maximum output of 300 tons. At the time of writ-

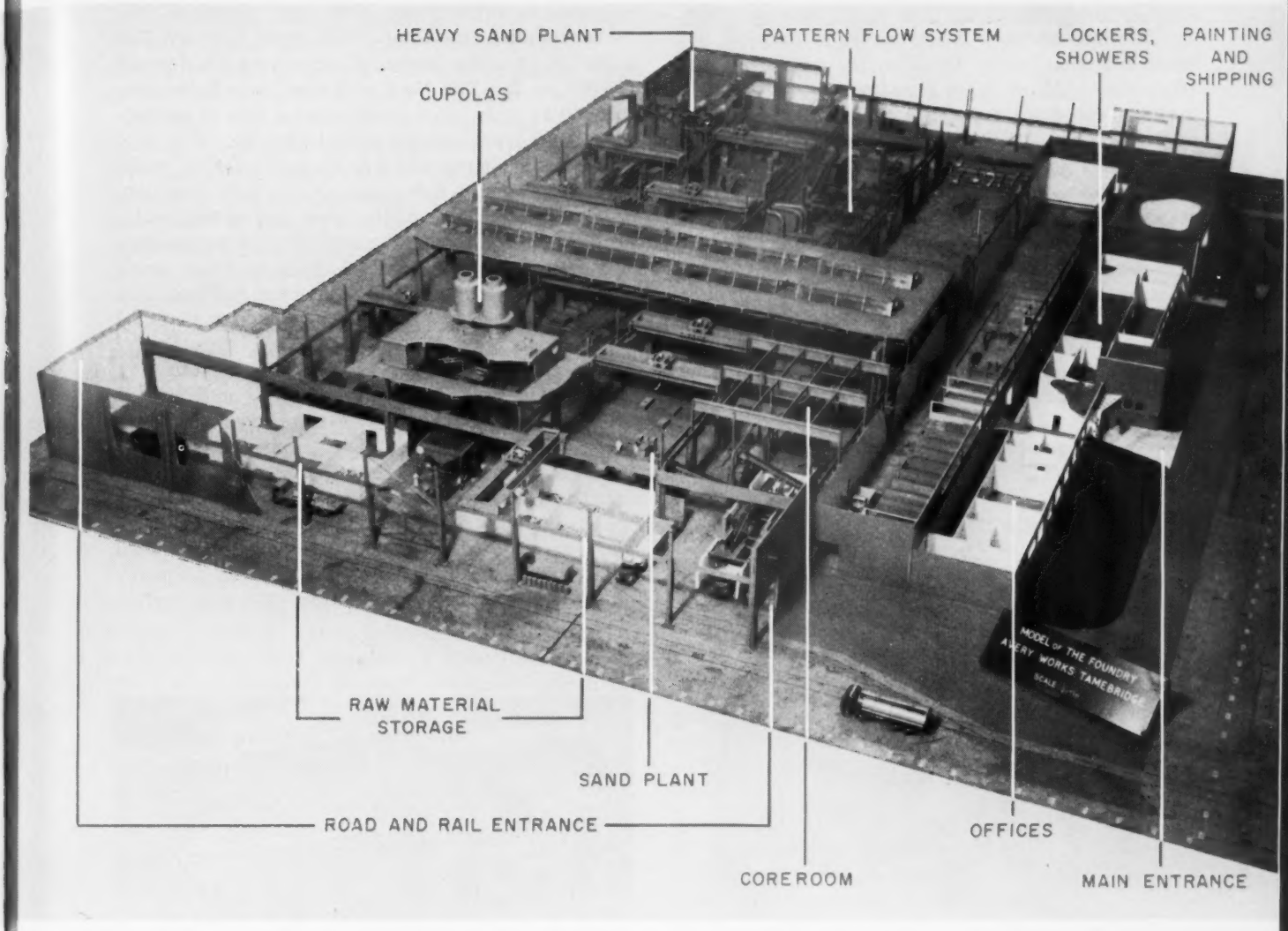


Fig. 2—Model W. & T. Avery Ltd. foundry shows layout of plant, which is 330 by 510 ft. Floor is divided into four bays, each 60 ft wide, separated by truck lanes

Fig. 3—Pig iron and scrap are handled in the stock bay by crane magnet. At the foot of cupolas, behind them, is weighing hopper into which materials are dumped

ing it is producing at the rate of 150 tons per week, the transfer of work from the Soho foundry not being yet completed. The foundry employs about 160 people, 125 of them foundry operatives. The castings are plain gray iron and range in weight up to 5 tons, although the plant and equipment permit making castings up to 10 tons. All handling is done by industrial trucks and overhead cranes. The foundry uses five 20-ton, two 10-ton, four 5-ton and 2-ton traveling cranes.

This plant is noteworthy not only for its modern facilities and efficient layout, but also for its ample space and its good lighting and ventilation. Adjoining the foundry is an employees' block which includes heated lockers, shower baths, drinking fountains, a canteen and a first-aid station.

Plant Under One Roof—The entire foundry, 330 x 510 ft, is under one roof, occupying an area of 168,000 sq ft. The floor is divided into four bays, each 60 ft wide, separated by wide tracks permitting rapid transport by electric trucks. One bay at present is empty and will be used later for making light castings now made at the Soho foundry. Raw materials arrive at the lower end of the foundry (see cutout model illustrated), where passage is sufficient for a standard gage railroad track which passes through and inside the building, and also for the passage of lorries. The raw material bins therefore are under cover.

Only one grade of sand is used for molding and one for coremaking. Each type of sand is stored in 300-ton capacity bins which are used mostly as a reserve. Sand normally is passed, on delivery, through a grid at the foot of the main bins and carried directly by elevators and overhead conveyors to hoppers of 17-ton capacity. The coke bin has a capacity of 300 tons. Pig iron can be stored up to 1230 tons and scrap to 1200 tons. Capacity of the limestone bin is 40 tons. Seacoal arrives

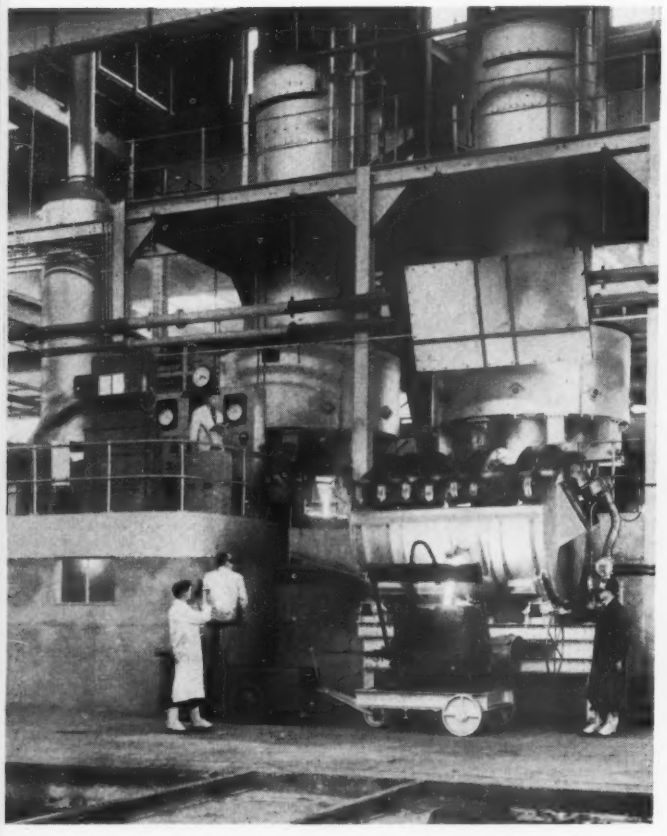


Fig. 4—Two continuous-tapping cupolas melt 9 tons per hour. They are used on alternate days

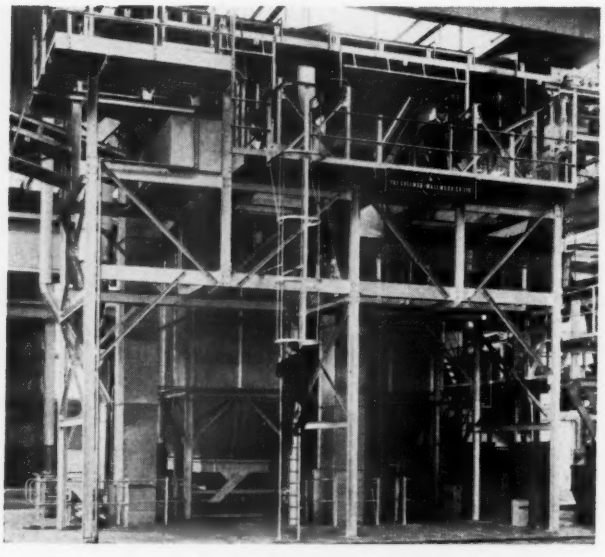


Fig. 5—Two high-speed belts feed shakeout sand into two 4-by-22-ft, rotating cooling screens

Fig. 6—Locomotive-type sandslinger makes large molds. Its ramming speed is 2000 lb per hour

Fig. 7—Medium-weight parts are cast by a "pattern flow system," controlled from this station

from the suppliers in specially designed, 1000-lb capacity closed bins to avoid dust dispersal.

Molding Sand—There are three sand plants: One for facing sand, serving the whole foundry; a heavy sand plant for the locomotive sandslinger, and a medium sand plant incorporated in the "pattern flow equipment" which will be described later. The first sand plant can be seen at the center of the lower part of the model. It handles sand in 560-lb batches. New sand is received from the 17-ton hopper, and used sand is received from another hopper and riddled. Both are weighed into a loading skip, which raises and discharges the mixture into the mill (Fig. 1). Seacoal is measured by a special vibrator device from the containers already mentioned, and water is added through a meter. The mill discharges through a disintegrator and riddle. The various operations are effected mechanically and are synchronized, like most of the operations in this foundry. Prepared sand is transported by electric truck or front-end loader to the molding stations.

Core Sand—The core sand plant is adjacent to the molding sand plant. Sand here also is mixed in 560-lb batches. It is dried in a rotary oil-fired drum at 400° F at the rate of 3300 lb per hour. Dried sand is drawn through a vacuum pipe to a cyclone and into a hopper of 14-ton capacity, above the core sand mill. Length of travel is 140 ft, sufficient to cool the sand. Sand from the hopper is measured into the mill as required, binders are added in measured quantities from specially designed tilting drums to avoid spilling, and the water is added from a visual measure. Prepared sand is discharged into a barrow for distribution to chutes feeding the coreblowers and core benches. Layout of the platform makes the use of barrows simple and quick. Blacking is mixed on the platform, in a 5-gal paddle mixer, and is piped down to the spray guns at each core bench. These sand plants were built by August's Ltd., Halifax.

Cupola Charging—Pig iron and scrap are handled in the stock bay by crane magnet. The stock bay is located to the left of the cupola plant in the illustrated model. At the foot of the cupola plant, and behind it, is a weighing hopper into which the materials are dumped (Fig. 3). Coke is brought from the main supply in specially designed baskets and delivered into a 10-ton hopper placed over the weighing floor. This amount is sufficient for one day. The coke is weighed separately, by hydraulically controlled hopper scale, and dumped into the main floor weighing hopper.

The combined charge of metal, coke and limestone is registered item by item on a recorder tape and dropped into a drop-bottom, self-closing bucket which is raised automatically by skip and discharged in the cupola, then lowered and reset for the next charge, which already has been weighed. The maximum charge is 2000 lb. The main Avery weighing machine has a capacity of 2995 lb, with recording tape and slave dial for the crane operator. The separate coke weighing machine, also by Avery, is of 500-lb capacity. Two men take six minutes to prepare and weigh a charge.

Melting—Average composition of the iron used is Si 2.1 to 2.3 per cent, S 0.1, P 0.8 to 1.1, Mn 0.5 and TC 3.1 to 3.3. From 5 to 10 per cent of steel scrap usually is added to the charge. Two continuous-tapping cupolas have been installed (Fig. 4), each being used on alternate days and melting 9 tons per hour. The cupolas are operated on cold blast, but the wind belt is designed for easy modification for hot-blast operation if required. The blast is governed by air-weight control. A control panel is located on the operating platform, including a recorder to indicate the number of charges going into the cupola. A chart shows the cupola attendant when composition of the charge is to be changed in accordance with the pre-established working schedule. When a change occurs, a bell rings and the attendant regulates the flow of metal accordingly. Dials, recorders and signal lights indicate the status of the various operating factors.

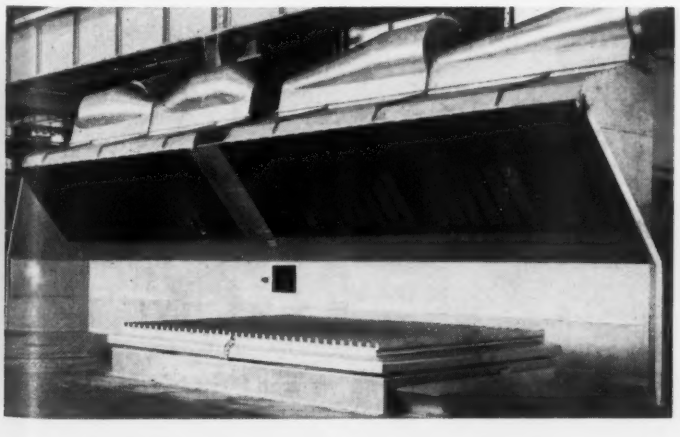
Slag is run off continuously into a water trough and is granulated before discharged into a dredge tank. Hot gases pass through a dust arrester and are water washed before discharge into the atmosphere. This operation uses 142 gal of water per minute. Waste matter is collected in the dredge tank. River water is used and is discharged from settling "lagoons" into the river cleaner than when withdrawn.

Hot metal is tapped continuously into an 8000-lb oil-fired receiver through a channel along the axis of the receiver. This unit maintains the temperature of the metal until it is transferred to ladles of 1500 to 7000-lb capacity. Ladles are taken to the pouring stations by electric trucks. The melting department also includes a cupolette for melting special alloys when required.

Molding Stations—Two molding stations are operated at present, one for castings up to 3 tons in weight, the other for castings of several hundred pounds. A third station for lighter castings, is to be located in the bay shown on the right side of the model. All molding is done in green sand.

Heavy Sand Plant—This plant, which prepares the molding sand for the sandslinger station, has two storage hoppers of 135,000-lb capacity. Mounted immediately above these hoppers are two high-

Fig. 8—Total load capacity of heavy shakeout is 45,000 lb. The twin tables are 10 x 16 ft



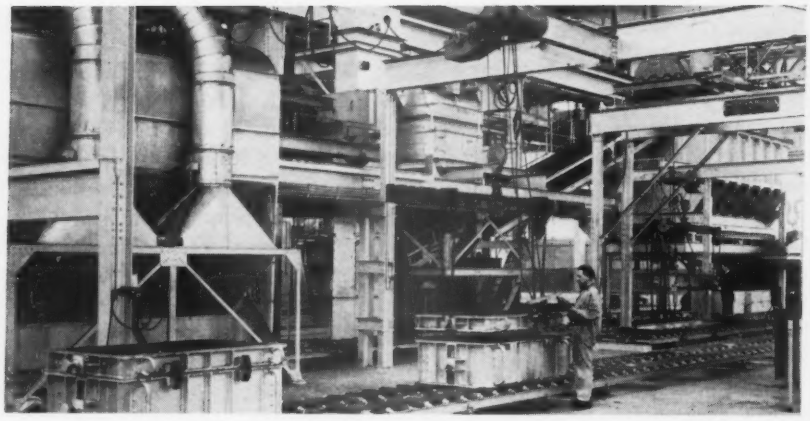


Fig. 9—In pattern flow system for medium parts, patterns are stacked at end of roller conveyor and placed on it, in turn, by crane and sling

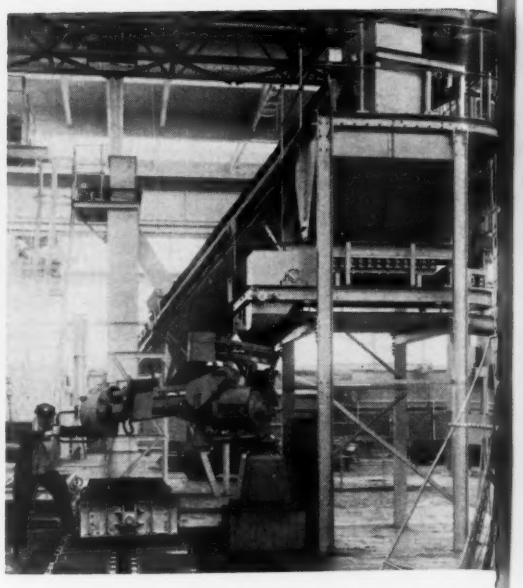


Fig. 10—Facing sand is added to the empty flask, on its pattern board, and flask then is transferred by mechanical carriage to the sandslinger

speed belts feeding shakeout sand into two 48-in.-diam by 22-ft-long rotating cooling screens (Fig. 5). Sand is taken from the bottom of the hoppers by vibrator trays feeding a belt 30-in. wide which delivers it, via bucket elevator, to the overhead paddle mixer. The mixer has a capacity of 100,000 lb per hour.

The sand passes through a paddle mixer of 65,000 lb per hour capacity. Seacoal is added from the overhead containers already mentioned and is discharged by vibrators. The mixer discharges the sand via overhead belt and plows to the sandslinger hoppers. The sand plant is automatically controlled, and was built by Coleman Wallwork.

Locomotive Slinger — A locomotive-type sandslinger is used to make the larger molds at a ramming speed of 2000 lb per minute (Fig. 6). All operations are controlled by one operator seated on the ramming head. This slinger, one of three of its type in Great Britain, carries its own sand supply in detachable hoppers, each of which holds 35,000 lb and can be replaced when empty while ramming continues. A plow near the head permits sand to be spilled into the flask for cushioning before ramming starts. The molding floor is laid out to permit the fullest utilization of the sandslinger in order to eliminate excessively long travel of overhead cranes and to curtail the amount of labor done by skilled men. Steel flasks are used, of such sizes as 10 ft 6 in. x 9 ft x 9 in. and 21 ft x 4 ft 6 in. x 3 ft. Some hold 15 tons of sand.

Metal is poured from ladles which are brought by electric trucks from the cupolas and tilted by crane. When filled, the molds are lifted and carried to the heavy shakeout, claimed to be one of the largest in Europe (Fig. 8). It has twin tables 16 ft long over-all by 10 ft wide, with a total loading capacity of 45,000 lb. Extension grids permit the shaking out of flasks 25 ft long. Average shakeout time per flask is 16 seconds. The dust exhaust system extracts 72,000 cu ft per minute. Equipment in the roof controls the admission of hot or cold air.

Shakeout sand travels by belts and elevator past a magnetic separator to the bulk storage hoppers already mentioned. There the used sand is held until required for reconditioning. All spent sand and refuse is dumped in this shakeout when it is not in use for the molding station, and a diversion plow routes it to a hopper outside the building. Molds are knocked out at night.

Pattern Flow System—The casting of medium-weight parts in quantities is done under a system known as the "pattern flow system," developed successfully at the Soho foundry six years ago. This section of the foundry is self-contained, including its own sand reconditioning plant, sandslinger and shakeout station. A complete cycle, from the time the empty flask leaves the shakeout station to the time it is stripped, is divided into a number of operations, each one being planned to last 12 minutes, with one or two men at each section. The operations, based on motion study, are controlled from a station shown in Fig. 7.

A number of patterns, lying on boards in a given order, are stacked at the side of the far end roller conveyor shown in Fig. 9. Patterns are taken in turn and placed by crane and sling on a section of roller conveyor; the empty flask is conveyed from the shakeout and placed on the pattern board, and facing sand is added. It then is transferred by a mechanical carriage to the sandslinger (Fig. 10), which has a maximum ramming speed of 800 lb per minute. Operation of the sandslinger is controlled at the ramming head. A plow near the ramming head permits sand to be spilled into the flask for cushioning before ramming starts. The overhead feed hopper is of 10,000-lb capacity and is governed by a bin level indicator which automatically cuts out the continuous mill and all feeders when the hopper is full.

While one section of the mold is being rammed, the other is being made ready. After ramming, the flask is pushed along the track beyond nonreturn stops, and excess sand is removed. It falls through a grid onto a belt which brings the sand back into the system for reuse. A vent frame then is placed onto the flask to insure that vent wires do not foul

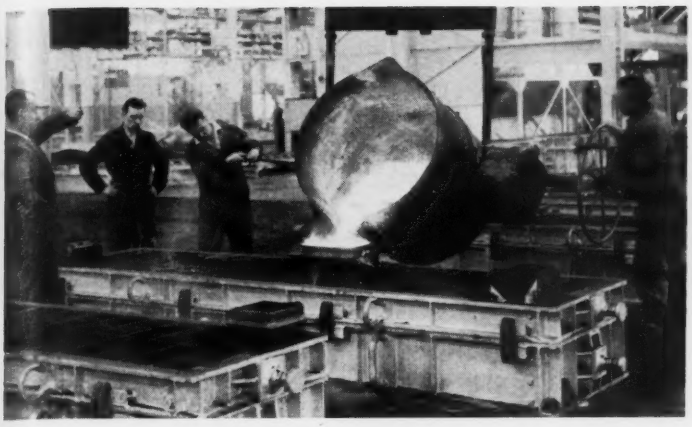


Fig. 11—Molds are carried by crane to the floor where they are poured, then conveyed to shakeout

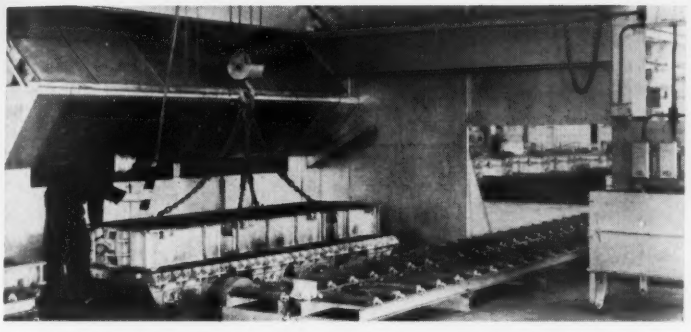


Fig. 12—This shakeout has twin tables 4 x 12 ft and has a total loading capacity of 20,000 lb

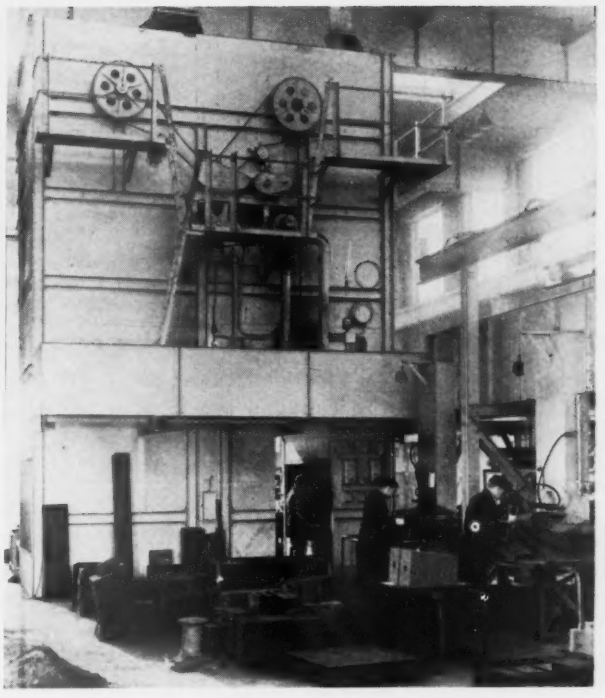


Fig. 13—Cores are baked, according to size, in either a batch-type oven or a continuous unit

the concealed pattern.

The next operation is to roll over the flask with a crane and an ingeniously devised sling; the pattern then is removed, assisted by a special vibrator. The pattern is turned over and placed on its return track to be replaced in the holder in the correct order. The flask is advanced to await its mating half, which is following in sequence. The operations of touching up each half, coring up and closing the molds are at the last position. The mold is then carried by crane to the floor, where it is poured (Fig. 11) and conveyed to its shakeout.

This shakeout (Fig. 12) has twin tables, 12 ft long over-all by 4 ft wide, and has a total loading capacity of 20,000 lb. Average shakeout time per flask is 10 seconds. The dust exhaust system extracts 24,000 cfm. Shakeout sand, after magnetic separation, travels to the left by belt and elevator to an overhead screen and finally to a bulk storage hopper, ready for reconditioning in a continuous sand mill which discharges the sand via underfloor belts and elevator to the sandslinder hopper. Seacoal is added by vibrator. Equipment is by Foundry Equipment and Paterson Hughes. Empty flasks are returned by roller conveyor to meet their patterns, and the cycle begins again. Castings are removed to the cleaning station by electric trucks.

Coreroom—Cores up to 50 lb are made on coreblowers as much as possible, bench work being reduced to a minimum. A receiver-type blower is used for coreboxes up to 24 in. long by 14 in. wide, and it can be adjusted to depths from 4 to 10 in. A circular roller track links the machine with the core oven. A bench blower is used for cores up to 2½ lb. Core benches are designed according to the latest motion study principles, with individual racks, bins, pneumatic rammers, blacking spray guns, etc. A small sandslinger also is used, at present experimentally.

According to their size, cores are baked either in a batch-type oven or in a continuous unit. The batch oven has an inside length of 15 ft 6 in., a width of 6 ft 8 in. and a height of 6 ft 6 in. The oven is oil-fired, recirculating and thermo-controlled and has air-operated doors. The baking period is three hours at 450° F. A cooling hood is provided at the exit. This oven can take two trucks, each capable of carrying a load of 10,000 lb.

The continuous, oil-fired oven has two zones—one for baking at 550° F for 80 minutes and the other for cooling, in 80 minutes. It has 47 carriers, each capable of a load of 350 lb. Time cycle and temperature can be varied to suit either oil or resin cores. The oven is designed with a tunneled passage between the open section of the carrier chain and the body of the oven to facilitate placing the cores on the shelves of the carriers.

Cleaning of Castings—Large castings are wet scrubbed to remove sand and cores. The medium-type, smaller castings are cleaned by shot blast in an airless blast, table-type machine. It is 10 ft square with a retractable, revolving table. Two impellers direct the shot stream so that all sides of the castings are cleaned in one operation. The castings then are dressed by hand chippers and grinders plugged into tool posts. Each of these posts carries three services—high-cycle current, compressed air and vacuum.

Aerial view of plant. High and low bay areas are clearly visible. Offices and laboratories are in low addition in foreground. Expansion will be to the left

Casting Facilities Prominent in New

Westinghouse Pilot Plant

By KENNETH L. MOUNTAIN
Associate Editor

A NEW LINK in Westinghouse Electric Corp.'s metallurgical development facilities has been opened at Blairsville, Pa. A $6 million metals pilot plant, containing 180,000 sq ft, it is designed to process both wrought and cast alloys with equipment flexible enough and large enough to allow actual manufacturing operations.

Plant was conceived from engineering studies made when it became apparent that the key to advanced design in steam and gas turbines, generators, transformers and nuclear reactors was the development of new metals with better temperature, strength and magnetic characteristics.

Selection and installation of all plant equipment centered around two factors—flexibility and multipurpose usefulness. As important as the development of new alloys is the need for practical commercial processes to convert them into finished products.

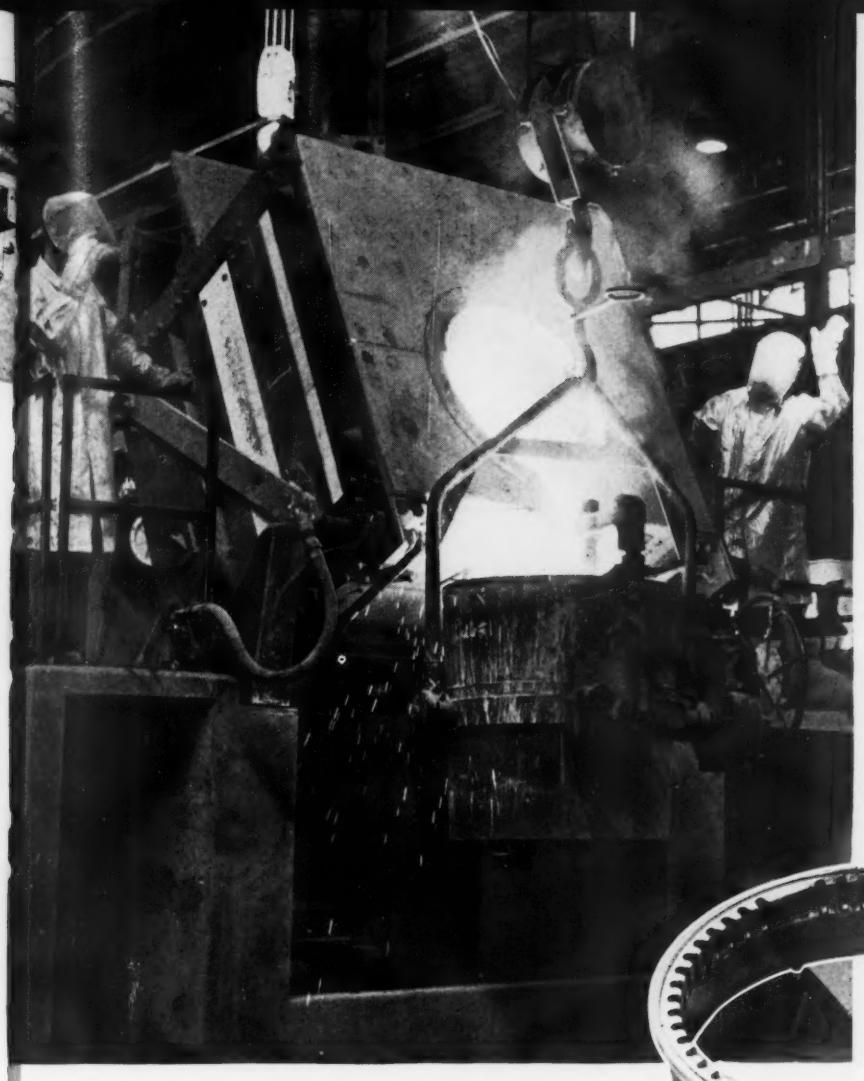
For this reason the equipment is larger than that found in most pilot plants. This setup permits manufacture of specialty metal products at competitive costs while allowing reasonable loading of tools which normally cannot be fully loaded on development work. It is hoped that manufacture of sizable quantities of a new product will reveal problems that will not come to light in any other way. The need to meet production schedules will determine the commercial practicability of newly developed processes.

Emphasis on simplifying and automating recent advances in investment and shell molding is designed to incorporate these processes into manufacturing lines with the same ease as machining operations. In keeping with current manufacturing philosophy, this step will lead to decentralization of Westinghouse foundries.

Ground was broken in May, 1954, with operations beginning on a reduced scale in May, 1955. At present, 270 persons are employed, about a half of them maintenance and operating workers and the remainder research and technical personnel. When full-scale operation is reached in April, 1956, about 500 persons will man the facility, split the same way.

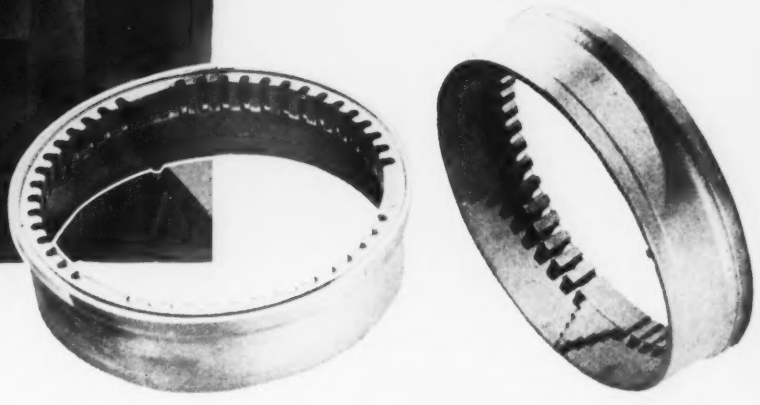
The one-story building is located on a 542-acre site 40 miles east of Pittsburgh. Office and laboratory area occupy 18,400 sq ft, with the remainder devoted to shop and service areas. Latter have been located at one end of the building, freeing space for possible future expansion. Roof of the office and laboratory bay is built to permit a second story. Structural steel frame construction is used throughout. Exterior walls are concrete block for first 6 ft, steel sashes for next 4 ft above and treated iron paneling for remaining height. Two bays measure 60 x 480 ft, 20 ft to truss; two bays are 60 x 480 ft, 36 ft to truss, and one bay also is 60 x 480 ft, 30 ft to truss.

Facilities Are Varied—Included in the plant are



Charge being poured from 3000-lb induction melting furnace. A 4-ton jib crane tilts furnace. An overhead crane supports ladle

Green shell mold prior to being placed in curing oven behind the pattern plate



Garbage disposal shredder ring is being cast by the shell mold process on a production basis for company's own end use

shell mold, investment casting and powder metallurgy facilities; a shot pouring unit; arc furnaces; three sets of induction melting furnaces varying in size up to 5000 lb; two cold hearth furnaces, seven forge furnaces; bell-type and roller rail box-type electric furnaces; an 18,000-lb and three smaller forge hammers; a 1000-ton steam-hydraulic forge press; a 2500-hp reversing, hot-rolling mill; an 1100-hp reversing, cold-rolling mill and other, related equipment.

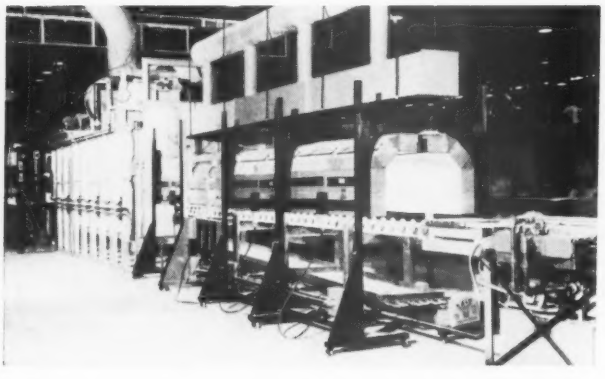
Westinghouse has manufactured precision castings and shell molded parts for several years, but conditions for economical production have been limited. A large part of the Blairsville metals plant is devoted to a small-scale production foundry designed primarily for the manufacture of various investment castings and shell molded parts required by several company divisions.

The specialized casting facility within the pilot plant is composed of two sections—a manufacturing engineering section and a production section. Primary purpose of the engineering section is to carry on development work necessary to keep the company abreast of all progress in investment and shell mold casting, heat treating and powder metallurgy fields. The production unit aids the company in maintaining such engineering groups for development work at a minimum expense to the divisions. Efforts of the engineering personnel result in new processes, cost reductions and more efficient production practices, all of direct benefit to the production operation.

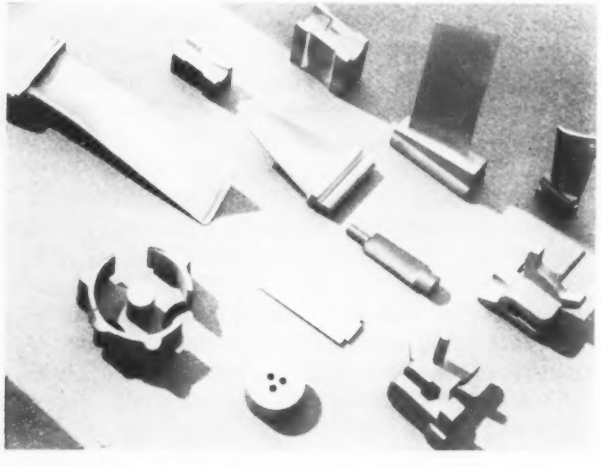
Production experience of the casting section has been gained from making a variety of turbine blades. Blades are from 1 to 10 in. long and from simple to complex airfoil sections. Shell mold experience has been limited, but with acquisition of new equipment, applications for shell molded parts within the company are expected to expand.

Smooth flow of raw materials and work-in-process was of prime importance in laying out the casting facility, as well as the entire plant. In both the investment and shell mold processes. large quantities of relatively inexpensive material must be handled economically. For this reason, equipment was located so that work flows smoothly from one section to another. For example, since air conditioning of the wax and investing areas was considered essential for pattern stability and uniform mold setting characteristics, the air-conditioned areas are located for receipt of incoming materials to the investment area and supplying the finished

Three pouring teams are used in the shell molding section to expedite movement of metal from furnace in rear to waiting molds in foreground



Investment casting molds move slowly through a dewaxing oven in a 23 hour cycle. Wax is melted from molds, falls to drip pans and is reclaimed



Intricate and complicated shaped parts with a cross section to 4 sq in., 8 in. in length and 8 lb in weight are cast by investment technique

molds to an adjacent melting section.

Poured molds, whether investment or shell, are fed directly to a central cleaning section and from there directly to the finishing section. Heat treating facilities are immediately adjacent to the finishing group for those castings requiring such treatment. Conveyors carry finished parts to quality control for inspection.

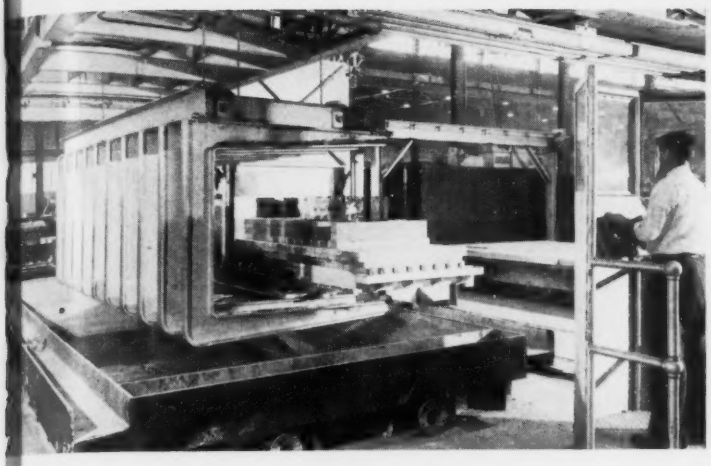
Investment Casting Practice—In the wax injection area, four presses capable of injecting wax at 500-800 psi under clamping pressures of 6 to 7 tons are used. Capacities range up to 18 cu in. with weights to 0.68 lb. One multiple station machine for injection, cooling and stripping works three dies simultaneously. Clamping pressure of 8 tons is the only limit to piece size.

Prior to investment, patterns are hand assembled into clusters or mounts. A sheet steel flask is placed around the mount, forming the mold, and the mounts are invested by pouring a refractory type slurry into the flask until the mount is covered. Investment is two-stage type. Wax mount is given a precoat by dipping to provide intricate surface details and finish, followed by the complete immersion in a coarse, refractory slurry.

After pouring, the molds are vibrated to pack the investment around the mount, remove any entrapped air and bring the liquid portion of the slurry to the top of the molds.

Vibrated molds are set aside while the refractory sets. Top portions of the molds, containing the fines from the investment and the supernatant liquid, are cut off about 1 in. above mount height. Molds are air-dried for 30 hours before movement to the dewaxing oven, where wax is melted.

A battery of infrared lamps generates temperatures of 300-400° C at front end of the dewaxing oven. A gas-fired unit at the rear of the oven creates temperatures to 875-1000° C. Molds are in oven for 23 hours. Hot molds are taken from the oven and clamped on 12-lb-capacity, mechanically rocked, indirect-arc furnaces. Metal is poured



High temperature solution heat treating furnace moves load into either oil or water quench tanks

at temperatures and conditions applicable to the particular alloy involved. Molds usually are poured under slight air pressure. Atmosphere melting can be done where required. Furnace meltdown time is 10 to 15 minutes.

Dry investment is composed of 70-100 mesh silica, 325-mesh flint and 50-mesh $Al_2O_3 \cdot SiO_2$ grog. Refractory binder is composed of sodium silicate and nitric acid or sodium silicate and hydrochloric acid. Nitric binder is used where reactions between mold and metal are not a problem. Hydrochloric binder is used with steels to avoid metal and mold reactions.

Shell Molding Operations—Two machines are used in the shell mold section. One can handle matchplates 15 x 20 in., and the other can take two 20 x 30-in. matchplates or four 15 x 20-in. Average weight of molds cast is 10 lb. Shells are made from zircon sand blended with phenol-formaldehyde resin in a special muller. Pattern plate is heated to 400-500° F. Shell is ¼ to ⅜-in. thick upon removal of excess sand-resin mix.

Cope and drag sections are bonded together on a press while still hot, with phenolic resin adhesive. Molds are placed unbacked on a rack, and pouring teams are used to empty the furnace quickly. Since castings are relatively light, small ladles are used. A high-carbon (1.5 per cent), 12-per cent chrome steel is used on a garbage disposal shredder ring being cast on a production basis.

Four furnaces are available to this area. Two are 250 kw with 650-lb capacity and two are 100 kw with 100-lb capacity. Meltdown time is 70 minutes in the 650-lb units and 40 minutes in the 100-lb units.

An induction vacuum melting furnace of 300 to 2000-lb capacity is built for batch-type operation, but can be converted to a semicontinuous furnace. It has attachments for bridgebreaking, measuring temperature, sampling the molten bath, arc hot-topping the ingot, hydrogen deoxidizing the molten bath and making additions to the bath. All attachments work within the vacuum chamber while it is under a vacuum. During the processing of a 300-lb heat, the system maintains 0.5 microns pressure. A palladium catalyst, a dehumidifier and a P_2O_5 trap are used to obtain dry hydrogen for deoxidation.

Automatic and semiautomatic molding presses are used in a completely integrated powder metallurgy processing system, which includes a volume production sintering furnace, a high-temperature molybdenum element sintering furnace and a high-temperature tube furnace. Blending, ball milling and hammer mill equipment, a 300-ton hydraulic press, a 40-ton molding press (40 pieces per min), a 25-ton sizing press (60 pieces per min), a 15-ton rotary molding press (900 pieces per min) and tumbling and screening equipment also are located in the powder metallurgy section.

The air melting area contains three 3000-lb furnaces and two 5000-lb units. Motor generator setting for these units is 700 kw, 960 cycle. Melting time is 1½ hr for the 3000-lb furnaces, 2 hr for the 5000-lb furnaces. Furnaces are lined with rammed MgO and Al_2O_3. Alloys generally melted in these units are used for applications in gas and steam turbines; magnetic alloys are used in saturable reactors, magnetic amplifiers and choke coils; and an expansion alloy is used where an airtight seal between glass and metal is required.

Shot used as melting stock for precision casting is cast in 3000-lb lots in a 6500-gal-capacity tank. Alloys are poured through ceramic screens containing holes ⅛ in. in diam.

Heat Treating Area—The general heat treating area has a solution-treating furnace fired with natural gas with an input of 6 million Btu per hr. Maximum temperature is 2400° F with control of ±10 to 15° F throughout. Sand seals around car keep heat in. Two quench tanks provide oil and water quenching. Quenching can be done in a maximum time of 30 seconds. A charge 18 ft long and up to 10,000 lb can be handled.

A gas-fired anneal box furnace is used for general annealing purposes. Maximum temperature is 2300° F. Two electric furnaces are used for aging high-temperature alloys and normalizing and annealing steel shafts at closely controlled temperatures. One is a three-zone unit 18 ft long; the other a two-zone unit 12 ft long. Each zone is controlled by a welding electronic contactor.

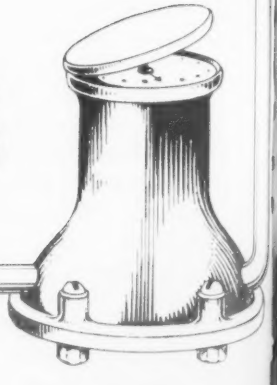
Three 36-in. bell furnace bases with two furnaces electrically heated in two zones can heat treat a charge up to 36 in. in diam and 48 in. high. Maximum temperature is 1100° C. Five 28-in. bell bases with four furnaces electrically heated in one zone are capable of heat treating material up to 28 in. in diam at maximum temperatures of 1225° C. In this area, all bells have three atmospheres available—dissociated ammonia, hydrogen and nitrogen—which can be made wet or dry.

This new plant, complementing newly constructed research laboratories and a materials engineering department (at other locations in the Pittsburgh area) is expected to satisfy company requirements for some years to come. Major progress is looked for almost immediately in fields of high-temperature materials, hard and soft magnetic materials, expansion alloys, resistance alloys and specialized foundry and powder metallurgy processes.

General view of the molding and pouring area. Larger molds, short-run work and jobs of a special nature are set off and poured on the floor-level conveyors in foreground

Medium-Size, High-Production Foundry

MAKES METER CASTINGS



By ROBERT H. HERRMANN
Associate Editor

THE foundry division of Neptune Meters Ltd. in Toronto is a high-production foundry, making brass and aluminum castings used in heating equipment and in meters for handling various liquids. Brass and copper pipe fittings also are produced. Weekly production of finished brass castings is about 75,000 lb; aluminum castings total 1000 lb. About 130 employees staff the two-shift operation.

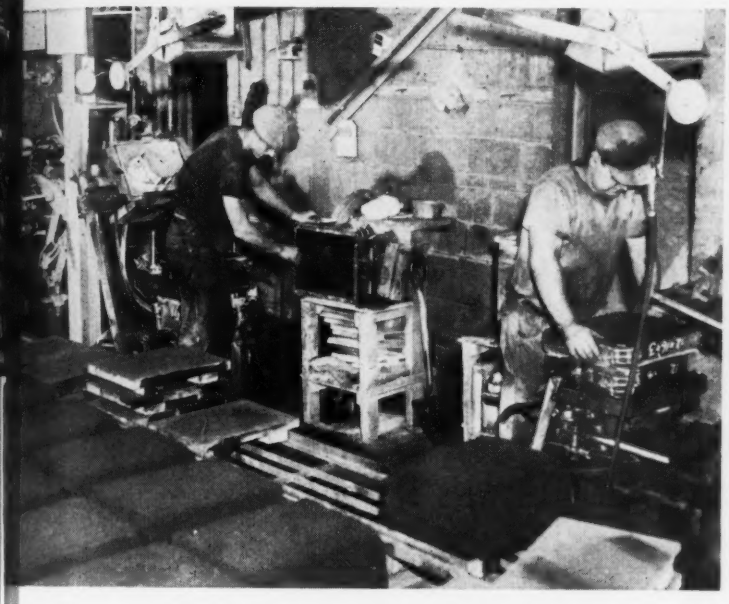
Molding operations are concentrated on a line of 14 machines fed with sand from overhead hoppers. The central sand preparation system includes a 50-ton capacity overhead bin which feeds through a rotating plate feeder to a skip hoist for charging 1000-lb loads to the muller. Western bentonite and wood flour additions are made as needed and water is metered. Eight tests are run daily on sand samples taken from the molding station hoppers. Moisture is held between 5 and 5½ per cent; green strength is 7 to 8 psi and permeability is 20.

A short belt conveyor carries sand discharged from the muller to a bucket elevator which empties to an 18-in. belt conveyor about 150 ft long. Hand-operated plows direct sand from this belt to each of the 14 molders' hoppers.

Molding—The line of molding machines includes four jolt-squeeze, seven squeeze-strip, two jolt-squeeze-strip and one jolt-rollover-draw units.

Molds made on the four jolt-squeeze and six of the squeeze-strip machines are set off on wheeled carriers about 18-in. wide and 6 ft long.

These molds ride on rails on a platform about 2 ft above the floor. Molds are poured along this platform. When the metal has solidified, the molds are pushed to a tilting track section at the ends of the rails. As the section tilts, sand and casting fall to a vibrating conveyor, and the change in balance on the track section causes it to tilt back to a set of tracks below the mold-carrying rails.



Smaller molds are set off on wheeled carriers as shown in lower center. The carriers roll on rails on a platform about 2 ft above the floor

The carrier with its bottom boards rolls along these tracks by gravity back to the molder's station. When he needs an empty carrier, the operator releases a catch and lowers a pivoted section of track to align with the lower track, pulls the empty carrier up on the tilting section and tilts the section to alignment with the upper rails.

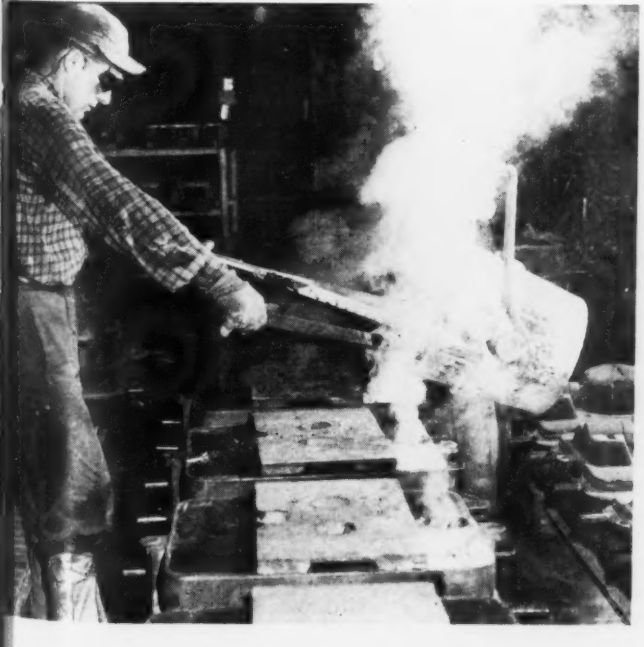
Molds made on the last four machines in the line are set off on gravity roller conveyors at floor level where they are poured. Workers push the cooled molds off the ends of the gravity rollers to a short section of roller conveyor which rides across the ends of the stationary conveyors on floor-level rails to the end of the vibrating conveyor. Molds are dumped into that conveyor by hand.

Near the end of the vibrating conveyor, sand falls through a screen in the conveyor pan to a bucket elevator and is discharged to a vibrating screen. Sand goes through the screen to the 50-ton-capacity bin above the muller. Scrap falls down a chute into a barrel. New sand is added to the system by handwheeling it from a storage bin behind the line of molding machines to the vibrating conveyor.

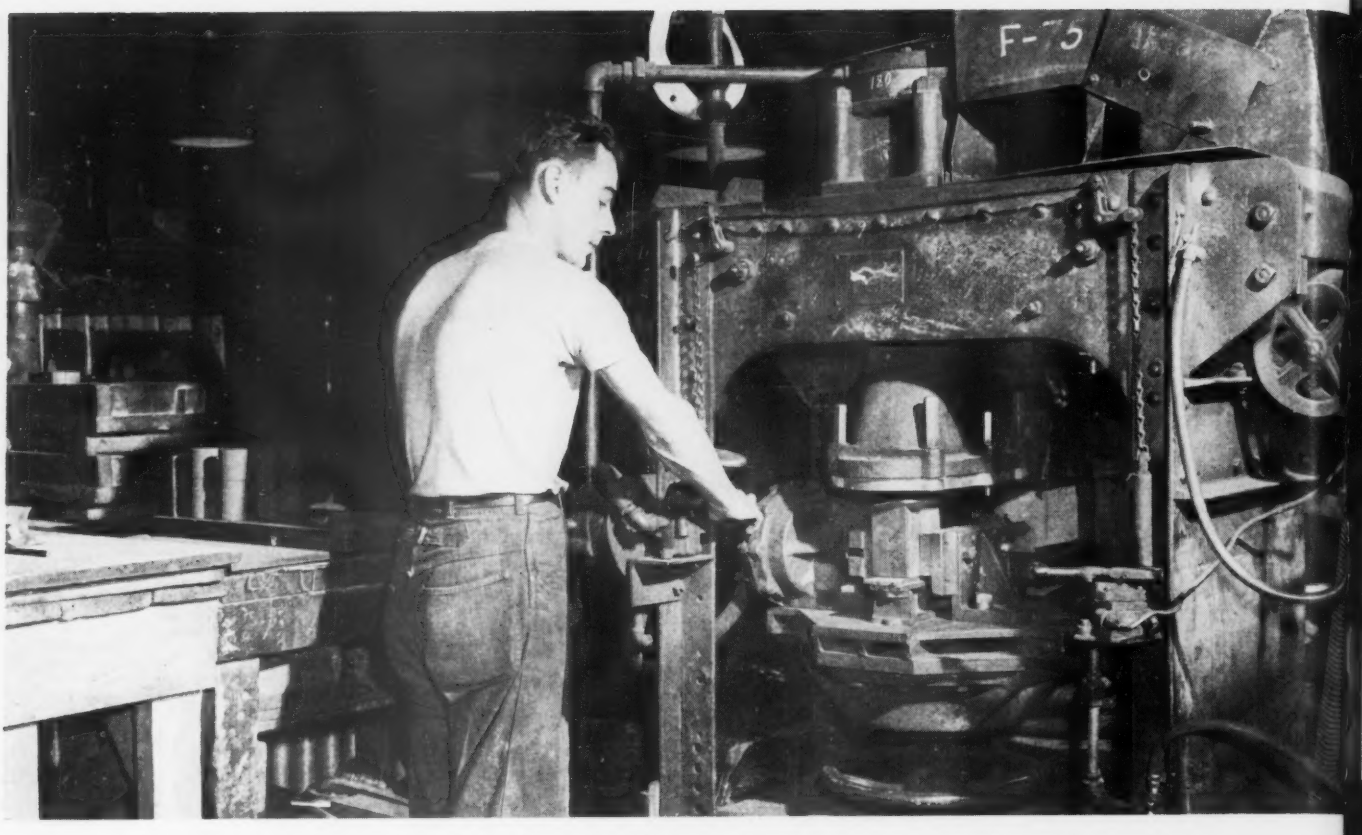
Opposite the four-machine molding area at the other side of the building is a floor and bench molding section where experimental and loose pattern work is molded. Adjoining this area and opposite the vibrating conveyor is the coreroom.

Coremaking—A combination wheelbarrow-mulling unit prepares the sand. The barrow is wheeled under the gated bottoms of either of two overhead storage bins to receive AFS 130 McConnellsville or AFS 57 Jersey silica sand. The basic sand mix consists of 1½ per cent dextrine, 1 per cent urea formaldehyde and small amounts of corn flour or western bentonite as needed. Moisture con-

Molds made in the section for special and short-run jobs are weighted and poured in the flasks. Note adequate safety equipment worn by workers



Tilting track sections in the carrier section permit molds to be dumped to vibrating conveyor. Boards remain on carriers for return to molders



Cores produced on blowing machines and benches are set on asbestos composition boards or in aluminum driers and carried to a tower oven for drying at 400-425°F

tent is ½ to ¾ per cent. One-half per cent ethylene glycol is added to help hold the moisture in the sand. This is done to lengthen the comparatively short air set time of the urea formaldehyde formulation. When used in blowing machines the basic mix is altered by the addition of small amounts of kerosene and oleic acid.

The muller tender wheels mulled sand in the barrow to coremaking stations and dumps it into floor boxes. Coremakers shovel the sand to machine hoppers or benches as needed.

Cores produced on seven blowers and three benches are set on asbestos composition boards or in aluminum driers and carried to a tower oven. Drying temperature is 400-425° F for varying lengths of time, depending upon core size.

Dried cores are unloaded with their plates and driers to a wheel conveyor for cleaning, patching and dipping. Hand-pushed, trolley-mounted shelf carriers on an overhead monorail carry dipped cores through a batch oven where they are dried for 10-15 minutes at 300° F. Inspectors group finished cores by job numbers into tote boxes and store them on racks of shelves between the core department and molding area. A worker carries them to molding stations as needed.

Melting—Control of metal quality starts at the receiving dock. Ingot is weighed when it enters the foundry, and samples are tested chemically. Scrap from the cleaning room and machine shop turnings are segregated into barrels and tagged with the proper alloy number. Barrels are trucked into the metal storage room.

Charges consist of 40-45 per cent ingot, with scrap and turnings making up the balance. However, turnings constitute no more than 10 per cent of the total charge. To make up the charges, a worker positions a hand-drawn platform truck on a floor scale and stacks ingot on it. Scrap and turnings are placed on the platform in shallow metal boxes. The truck is pulled into the adjoining furnace room, which is equipped with two 350-lb indirect arc rocking furnaces; four 500-lb oil-fired tilting crucible furnaces and four 250-lb oil-fired crucible draw, pit furnaces for brass melting. Individual hoods exhaust fumes from the rocking and tilting furnaces, and a common hood exhausts the four pit furnaces.

Aluminum is melted in a 1000-lb reverberatory furnace and transferred to three holding furnaces of 200-lb capacity each. The reverberatory and one holding furnace are oil-fired. The remaining two holding furnaces are gas-fired.

An overhead monorail circles the melting room and then traverses the mold pouring area. Hand-pushed ladles suspended from the monorail on trolleys deliver metal from furnaces to the pouring floor. In the floor molding and roller conveyor areas the ladles are switched off the monorail to bridge cranes for pouring the molds. Molds set off on the wheeled carriers are poured directly under the monorail loop. Roof fans ventilate the

Worker brushes on core wash and sets cores on trolley-mounted shelf carriers for oven drying

Furnace charges are weighed carefully and the weights recorded for close control of quality

Pouring ladles are filled at furnaces and moved to molds on an overhead monorail

A worker removes castings from apron conveyor and places similar types on skids. Low-lift hand trucks are used to move the skids to the various cut-off machines

Gating metal is removed by abrasive wheel, hand saw or power shear. Castings are tossed to tote boxes and scrap to barrels for further handling

floor molding and roller conveyor areas. A long hood over the monorail vents the mold carrier area.

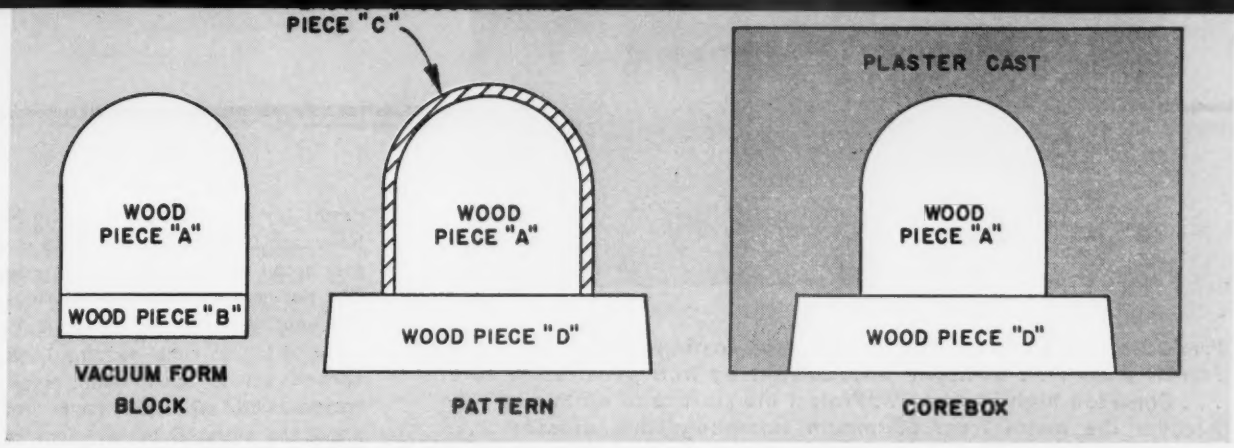
Castings Cleaning—Castings slide off the end of the vibrating conveyor to a below-floor-level apron conveyor. The conveyor travels up through the floor on the other side of an aisle and levels off at waist height. At this point, workers sort castings into skids. Low-lift hand trucks move the skids to two abrasive cut-off wheel machines, a power shear or band saw for removal of gating metal. Machine operators toss castings into tote boxes and scrap into barrels.

Boxes of castings are put on either of two gravity roller conveyors along each side of a row of three double-end grinders. Grinding machine operators throw ground castings into empty boxes on the conveyor and push them along. Some castings are chipped and ground with air tools on a bench along one of the roller conveyors.

Castings removed from the ends of the roller conveyors are cleaned in a tumble-blast unit. A skip hoist charges the smaller castings; large pieces are hand loaded. A combination of steel shot and grit is used to clean the castings. Additional cleaning room equipment includes a hand sand blast cabinet and a small tumbling barrel.

Inspectors visually examine all castings, and meter housings are tested with water. These castings are set on a rubber gasket and an air inlet pipe clamped by air cylinder to the top opening of the housing. A second air cylinder raises a container of water up to engulf the assembly, and air at 100 psi is blown into the casting. Bubbling in the water indicates a leaking casting.

Finished castings are loaded into shipping containers for movement to the company's own machine shop or to outside customers.



PATTERNS for Thin-Wall Castings

By R. H. WESTON
Pattern Shop Supervisor
Hoover Co., North Canton, O.

THIS article describes a new low-cost method of patternmaking for thin-wall sand castings. The method is applicable to both simple and complex types of patterns. Experience to date has indicated that by the use of this method, cost savings of from 30 to 40 per cent may be realized depending on the complexity of the pattern.

The principal feature of the method is the utilization of "vacuum forming" as a means of quickly producing a plastic replica of the part to be made. This plastic replica thus provides the shell thickness of the part to be produced without actually having to construct an additional part of the pattern for that purpose. This accounts for the cost saving.

Vacuum forming is relatively new in the plastics industry. It is a simple procedure which consists of laying a sheet of thermoplastic material over a wooden, plaster, phenolic, or metal form, heating it and then applying a vacuum. This causes the softened plastic sheet to be drawn uniformly around the form, thereby duplicating the shape and contour of the form. By choosing the proper thickness of plastic sheet, an exact replica of the part may be produced. The entire vacuum forming procedure requires only a few minutes to complete.

The manner in which vacuum forming is used in the construction of thin wall patterns for sand castings is as follows. Assume that it is desired to make a pattern for the piece *C* shown in the accompanying sketch. The various steps follow:

1. First construct three wooden parts consisting of:

Piece A. This piece is to be made to the shape of the inside contour of the part. It would serve as the form for the vacuum forming operation and also would be used later in making the corebox.

Piece B. This piece is to be attached to the bottom of Piece A to provide material for trimming.

Piece D. This piece is to serve as a cover core print.

2. The pattern is obtained by first vacuum forming a plastic sheet of proper thickness over the assembled pieces *AB* to form a plastic replica *C*. The excess plastic material is then trimmed at the junction of *B* and the resulting plastic-covered wooden form is then attached to the cover print *D*. This completes the pattern.

3. The core for the above pattern is obtained by using the same two wooden pieces *A* and *D*, which were previously used for the pattern. These two pieces, when properly located and placed in a box of suitable size, serve to form the contour of the core box. Hydrocal A-11 plaster cast is suggested as a material for this box. Having prepared the corebox as outlined above, the core is then formed in the usual manner.

Since the wooden piece *A* is used interchangeably for both the pattern and the corebox, it is desirable that the plastic piece *C* be made readily removable from *A*, even though the normal shrinkage of the plastic would tend to cause a tight fit. This can readily be done by making a thin coping saw cut at each corner of piece *C*, thus assuring a satisfactory slip fit.

In the event it is desired to add a nameplate insertion to the pattern, this can be accomplished merely by vacuum forming a second plastic piece *C* and using a section of it for a nameplate insert. After laying out and cutting out the nameplate design, the insert with the proper radius and contour can then be fitted into the original pattern with very little difficulty.

The system described here has advantages other than those of cost saving. The system is direct and accurate because the locating core print is not changed. This eliminates the principal difficulty of a wood patternmaker in obtaining uniform metal thickness. Furthermore, in the proposed system, micrometers can be used to check wall thicknesses and any minor differences can be taken care of by adding paper shims between the wood and plastic parts in the pattern assembly.

Questions and Answers

Production of statuary and ornamental castings aided by using French sand . . . Difficulty encountered by iron penetrating core . . . Bond too high in core . . . Protect the surface of aluminum . . . Recover the metal from aluminum skimmings and drosses . . . Holes in casting surface

French Sand Used in Statuary

QUESTION Can you give us any information on French molding sand, how it is used and its applications?

ANSWER French molding sand comes from near Paris, France. It is termed a fine sand. One screen test shows about 175 AFS fineness number, with over 65 per cent on screens 200 to pan, and an AFS clay content of about 17 per cent. Its bond content results in what the foundryman calls a strong sand or one which hold its shape well.

French sand is highly regarded by statuary and ornamental casting producers for several reasons. Its fine grain produces smooth surfaces, and in the dried state the sand is quite permeable. The sand usually is rammed hard, and since it holds its shape, drawbacks can be pulled away without any danger of breaking or sagging.

Core Penetrated by Gray Iron

QUESTION We have a problem in coring a gray iron casting having a cross section as shown in the accompanying drawing. Casting is 80 in. long, and due to the thin core we decided to cast on end. Pattern equipment was made for all core. We tried one casting and found, aside from many little faults we can remedy, our major trouble is from penetration into the small U-shaped cores. Mold poured good; had good gas vents, but suffered a run-out after approximately 1000 lb of iron was in the mold. Inspection of the cooled casting showed the core was penetrated with iron, and we would have been unable to remove it. We will appreciate suggestions on how to overcome the trouble with this casting, which requires a mold about 90 in. high including risers. We are reluctant to try pouring horizontally since on a previous occasion with a similar casting 57 in. wide, leaks developed around the chaplets used to keep the long, thin core from raising.

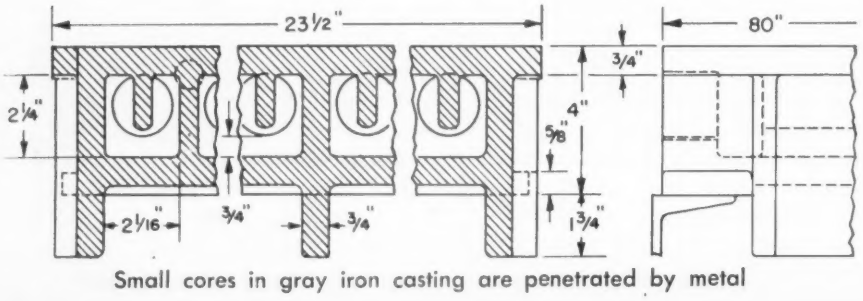
ANSWER Your difficulty with penetration primarily is due to the high pressure developed by the approximately 90-in. head of metal against the lower portions of the core where the greatest amount of penetration occurs. Pressure developed by a 12-in. head is about 3 psi while with an 84-in. head it is seven times as great, or 21 psi. This forces the molten metal into the interstices or voids between the sand grains.

It follows, of course, that the finer the sand with smaller voids, the less the difficulty from penetration; unfortunately, the lower permeability resulting from decrease in grain size limits the extent to which that step can be pursued. A further complication is that finer sands require more binder than coarser sands.

Possibly your trouble from penetration might be overcome by applying a suitable coating on the core. This will fill the surface voids and eliminate any place for the metal to enter. As you know, a number of proprietary materials are on the market, and the producers will be glad to supply information on the applicability of these materials. If you want to experiment on your own you might try one developed at the Naval Research Laboratory which is said to give good results. It is composed of 59.4 per cent 140-mesh silica flour, 1.5 per cent western bentonite, 1.5 dextrine, 0.1 per cent sodium benzoate (preservative) and 37.5 per cent water. Add 0.1 per cent wetting agent to provide better penetration of the coating into the voids between the sand grains.

Perhaps since your problem is urgent, the most rapid solution would be to make the core of zircon sand. That material, while considerably more expensive than silica sand, possesses a number of desirable properties such as high refractoriness, high thermal conductivity, high density, low expansion and resistance to wetting by molten metal.

Two recommended core mixes are based on hot strength properties. One possessing moderate hot strength is composed of 100 lb zircon sand (115-120 AFS grain fineness) 0.7 lb corn flour, 0.7 lb core oil and 2 lb water. The other for high hot strength applications contains 100 lb zircon sand, 0.5 lb corn flour, 0.5 lb western bentonite, 1 lb core oil and 2.5 lb water. Since heavy metal sections are not involved the first mixture having moderate hot strength properties should serve.



Small cores in gray iron casting are penetrated by metal

Casting Surface Shows Holes

QUESTION We were asked to make the male half of a die in aluminum, and since the female half was cast iron we decided it would serve as a permanent mold, but the resulting casting surface was full of holes. Surface of the die used as the mold was heated with a torch. Aluminum at about 1450° F was poured slowly without turbulence.

ANSWER While we are not sure of the cause of the defective surface on the casting, it possibly resulted from presence of oil, grease or other organic material on the cast iron die. Such material is often difficult to remove sufficiently to eliminate the formation of gases when in contact with molten metal. Again it may be that the cast iron die was not at the proper operating temperature—600 to 800°—for permanent mold work.

Although you mention no turbulence was noted, it may have been present, or possibly air may have been entrained in the metal stream. Perhaps if the mold could be tilted during the pouring operation so that

the aluminum would flow gradually and uniformly over the surface, a better distribution would result. You did not mention use of a coating over the cast iron die surface, but this might overcome the trouble. A number of coating preparations for permanent mold work are on the market. Coating should be thin and applied while the mold is hot, preferably by spraying.

Suggests Change in Core Mix

QUESTION We are making some brass bushings 10 in. long with ½-in. walls, using a core about 2½ in. in diam. When the cores are knocked out we find a lot of fins where the brass has eaten into the cores. We are using the 85-5-5-5 alloy poured at 1900° F. We were told that our cores were too soft, but a mixture given us by another foundry produced the same trouble. The core mixture we used consisted of 60 qt sharp sand, 30 qt bank sand, 1½ qt cereal binder, 5 qt good grade of core oil and 5 qt water. After drying, cores are painted with a core wash, but that did not help.

ANSWER Your difficulty arises primarily from the excess amount of binder in your core mix, and probably is complicated by lack of venting. The present 5 qt core oil to 90 qt sand gives a ratio of 1 to 18 which is extremely low; even a 1 to 40 ratio is considered heavy bonding.

We believe that you will obtain satisfactory results by reducing the core oil addition to 1½ qt to the 90 qt sand, and probably even better results will be found by eliminating the bank sand and using all sharp sand.

You do not mention whether a vent hole is placed in the core. If not, you should use a ¼-in. vent hole in the center, continuing it to the outside of the mold. Perhaps the core is made in halves and pasted together after baking, and the operators may plug up the vent with paste.

Coating of Aluminum Alloys

QUESTION Can you give us complete information on a metal finishing process called chromate for aluminum alloy castings? We saw in the May, 1953 issue of FOUNDRY a reference to it, but we wish more detailed information.

ANSWER So far as we know, the published description of the chemical process called chromating, chromatizing, etc., is complete. The procedure appears to function in the double role of neutralizing the possible traces of alkaline cleaners, and serve as a "tooth" for later painting. As mentioned, the method consists of immersing the part in a 5 to 10 per cent solution of chromic acid maintained at a temperature of 140 to 150°F. The part is left in the solution for about 5 minutes, rinsed in cold water and dried.

Possibly you may have in mind an anodizing process using chromic acid which we understand is patented. Essentially it comprises cleaning the work in a mild alkaline cleaner, followed by careful rinsing in hot and cold water. The work is made the anode in a 5 to 10 per cent chromic acid bath at about 95°F. Current at 5 volts is applied and raised to 40 volts in 3 to 5 minutes. Work is held at that voltage for about 30 minutes, rinsed in cold water, and then immersed in hot water at 200°F or above for 15 to 20 minutes to seal the oxide coating.

Reclaiming Metal from Dross

QUESTION We have an opportunity to set up a reclaiming operation to handle a very rich dross generated by a nearby aluminum die casting plant, and would appreciate receiving all available information on the subject. We especially are interested in the type of furnace we should have for efficient and economical recovery, also information on other equipment needed.

ANSWER Recovery of metallics from aluminum drosses involves considerably more than putting the material in a furnace with some flux, heating it up, and running off the molten metal. The recoverable part of the dross that is useful to you is that actually in metallic form, and it must be separated from oxides, fluxing material, etc. Possibly some additional return might be obtained by selling the latter to processors of aluminum salts, provided it is high enough in aluminum content.

Separation of the metallic aluminum from the dross is done by grinding in ball or hammer mills down to 20 to 40 mesh. Product from the mill is screened on vibratory type units, usually employing two sets of screens, one coarse and the other fine. Reason for this procedure is that higher metal recovery is obtained with coarser metallics, and the two types of screened metallics are melted separately. First screen may be 8 to 10 mesh while the second may range from 20 to 40 mesh, the choice resting upon resulting metal recovery. Metallic materials from the screening operations are passed over magnetic pulleys to remove any iron.

Melting procedure for the metallics will depend upon the quantities to be handled. With small amounts graphite crucibles or iron pots may be used, but hearth or reverberatory type furnaces are employed in large-scale operations. Preferable reduction method is the liquid heel and liquid flux method. Some heavy chunky aluminum scrap is melted down to form a small liquid heel in the bottom of the crucible, pot or furnace. It is covered with a suitable fluxing material which will be liquid at the operating temperatures. Fluxes include mixtures of sodium chloride and calcium fluoride and/or cryolite in the ratio of 85:15, for example. Many proprietary fluxes also are available.

After the heel with its flux cover is ready, the metallics are added in small amounts and pushed under the flux cover into the molten metal heel to minimize oxidation losses. Temperature of the molten metal must be controlled so that it remains quite liquid at all times. If the metal tends to become "pasty," feeding of metallics is stopped until the bath is fluid. The charging procedure is continued until a sufficient bath of metal is secured. Then the cover material is removed carefully to keep entrained metal at a minimum, and the molten metal is poured into ingots. Resulting ingots should be analyzed so that the composition is known.

Wants To Make Grinding Balls

QUESTION One of our customers has requested us to supply chilled iron grinding balls of 2, 3, 4 and 5-in. diam, and since we are not familiar with such work we will appreciate the following information: Does chilled iron mean that the castings are made in a metal mold? What analysis would be appropriate? Could a given life of such cast balls be predicted?

ANSWER Cast iron grinding balls originally were made in metal molds to insure a white fracture structure with high resistance to abrasive wear, hence the term "chilled" iron. However, by selection of an iron low

enough in silicon content, or by addition of chromium or combinations of chromium and nickel, a sand-cast product with a white fracture can be produced. In general, chill or metal molds are preferred since the silicon content does not have to be as low as in the case of sand casting.

Since melting and other practices vary from foundry to foundry, no definite reply can be given as to composition except to say that for the sand-cast process the silicon should not exceed 0.40 per cent, and not over 0.60 per cent for chill casting. However, some experimental work would have to be done to determine the proper content. The only way one could determine the average life, usually based on tons of material ground per ton of balls, is to carry on extensive field testing of various materials to be ground.

Abrasive Face on the Casting

QUESTION We have an order for a number of small aluminum alloy castings which are required to have an abrasive integrally cast into one surface. Since this is a new type of casting to us, we will appreciate any information you can give us as to regular procedure. We plan to use a No. 6 grit. Our main lack of information is concerning the type of abrasive or binder used to secure the grit to the mold face.

ANSWER While the procedure for making castings with abrasive-faced surfaces seems simple enough, skill and experience are required to obtain the desired results, and you will have to experiment to develop the most suitable method.

Steps in the process are to coat the mold surface with some type of adhesive, apply the abrasive grain, skin dry, close the mold and pour. A wide variety of adhesives are employed, including thin clay wash, molasses water, sulphite pitch solution, bentonite in water with or without a small amount of sodium silicate, sodium silicate solution, etc.

The adhesive preferably is sprayed on the mold surface to provide a thin uniform coating. The abrasive grain is distributed carefully over the sticky surface by shaking through a screen or sieve having the same mesh size as the grain. Layer should be thin, and it may be advisable to spray the first layer with adhesive and apply a second thin layer. The No. 6 grit you plan to use—presumably 6-mesh — seems somewhat coarse. It is approximately 5/32-in. but the usual size is 12 to 36-mesh.

After the abrasive is in place, the mold face is skin dried to drive the moisture back sufficiently that the molten metal will lie quietly against it. Mold is closed and the metal poured. Metal should be hot when poured so that it will penetrate between the abrasive grains.

Degassing Copper-base Alloys

QUESTION Some time ago we saw a reference to use of dry nitrogen gas for degassing copper-base alloys, and we would like to know more about it. Our recollection is that mention was made that such degassing will replace deoxidizers, but since oxygen forms a compound with copper we cannot see what good it will do there. What is the normal amount of cuprous oxide to add to a melt before addition of 1½ oz of phosphor copper? Is the oxide added at the start or finish of the melt?

ANSWER A number of foundries are using dry nitrogen gas for degassing copper-base alloys. For alloys containing under 10 per cent zinc, the amount is about 0.4 cu ft per 100 lb melt. With higher zinc content, due to the fact that some zinc is removed in the process 0.1 cu ft per 100, is employed.

Nitrogen is admitted to the melt through a porous graphite tube to promote discharge in the form of fine bubbles. Degassing may be done before the metal reaches the pouring temperature, or the metal may be heated 50° F above the pouring temperature, the flame cut off and the metal degassed.

Function of degassing is to remove hydrogen, which is absorbed by the copper-base as well as aluminum and magnesium-base alloys during melting, and not oxygen. The action is purely mechanical; the small bubbles of nitrogen pick up those of hydrogen which are present in the melt.

As to copper oxide additions, since cuprous oxide (red) contains only about 11 per cent oxygen—compared with 20 per cent in the cupric oxide (black)—many foundrymen prefer the latter. About 1 lb per 100-lb melt is used when difficulty is encountered with gassy metal, and 4 to 8 oz as a safety measure. If cuprous oxide (red variety) is employed, the amounts would be 29 oz, and 7½ to 14½ oz. Deoxidation is done by adding 1½ oz phosphor copper.

Additions of copper oxide to the metal may be made by adding to the charge at the beginning. Or the metal may be partially melted, skimmed and the oxide added. Third procedure is to melt the alloy completely, add the oxide enclosed in copper foil in a phosphorizing cup and plunge beneath the surface until dissolved. Then the metal is stirred, skimmed and deoxidized with phosphor copper.

Iron Cools Much Too Rapidly

QUESTION Recently we had some trouble with castings throughout one heat. Iron seemed to come over the spout and into the ladle hot, but reached the molds dull and sluggish; indicating an oxidized condition. Details were as usual in preparing the heat except some of the coke was brought in covered with snow and possibly ice, and may have been used before thoroughly dry. Would the wet coke be responsible for this trouble?

ANSWER Description of the heat involving what appeared to be hot iron when tapped but which becomes dull and sluggish on pouring, describes an oxidized iron condition. This can be quite deceptive because the iron appears hot to the eye due to a very bright film on the surface of the metal. Metal undoubtedly is cold because the oxides generally do not show on the surface until the temperature is below 2700°F. The oxide film increases rapidly as the metal temperature drops because oxides are being thrown out of solution.

An experienced operator can detect such a film with his eye, but frequently such a condition passes unnoticed. The film always can be detected by using colored (steelmakers') glasses or an optical pyrometer. Such a condition can be caused by 1) Poor metal in the charge such as badly rusted scrap, hard iron, or insufficient pig in the mix. 2) Poor combustion in the cupola due to poor coke (too small or of poor quality), insufficient coke for the amount of air blown. This latter also includes low coke bed.

Wet coke directly could not be responsible for the condition mentioned. Indirectly it could be a contributing factor. If operating conditions were balanced on the ragged edge, wet coke could cause a reduction in the amount of coke charged which would gradually lower the bed during the heat. If the regular metal charges were barely passable, even a slight lowering of the bed could cause an oxidized condition. Frequently if the metal is not coming hot enough for the pourers, the cupola tender may increase the air and aggravate the unbalance mentioned previously. Our feeling in connection with the problem is that regular operation might be adjusted to a coke rate too thin. This includes the bed as well as the charges. This should be investigated and adjusted, or the second possibility is the inclusion of hard iron scrap, and that should be eliminated to produce normal gray iron.

A typical Iroquois product . . . a marine motor housing.

"We recommend this machine to all foundries"

Says Mr. Walter Vierthaler, Vice-President of Iroquois Foundry Co., Racine, Wisconsin, where high quality grey iron castings are produced. Here approximately 300 tons of mulled sand are conditioned each night with a Royer NYP-E Sand Separator & Blender.

Front end loaders deliver the sand from the muller to the molding station. The original practice was to dump this sand on the molders heap, caked and packed from mulling and bucket loading. Now the sand is charged into the large hopper of The Royer instead. No time has been added to the cycle of operation, but the molders heap has been transformed to a cool fluffy pile. When one floor is completed, the highly portable Royer is moved to the next. Scrap loss and cleaning room time are down and casting finish has been improved.

All mulled sand can be vastly improved by proper aeration and fluffing. The best place for this operation is at the molding station where the sand will not be compacted by further handling prior to the molding operation. For a bucket loader type of operation we recommend the new Royer NY series. Write for bulletin NY-54 today.

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MEN ... of Industry

DAVID C. EKEY
. . . research, Lebanon Steel

PAUL H. H. HOOKINGS
. . . Chapter Chairman, AFS

D. FRANK MEDEROS
. . . Walworth Co. executive

LOUIS LIPPA
. . . pres., Apex Smelting Co.

DAVID C. EKEY was appointed director of research, Lebanon Steel Foundry, Lebanon, Pa. Since 1951 he was assistant professor of industrial engineering and head of the foundry option course, Pennsylvania State University. After graduation from Ohio State University he was associated with Murray-Ohio Mfg. Co. and Cleveland Automatic Machine Co., Cleveland. Later he was a project engineer for Ohio Malleable Iron Co., Columbus, O.

Edward P. Sadowski, for the past two years associated with the Eastern Research Laboratory, Crucible Steel Co. of America, New York, recently joined the Development and Research Division, International Nickel Co., there, as a research metallurgist in the iron alloys section. A graduate of University of Notre Dame, Mr. Sadowski was formerly with M. W. Kellogg Co., New York.

Dr. Wingate A. Lambertson, formerly assistant director and professor of silicate chemistry, Institute of Silicate Research, University of Toledo, was appointed assistant to the manager, Research Branch of Research and Development Division, the Carborundum Co., Niagara Falls, N. Y.

M. H. Smith, since 1952 chief engineer at Hyster Co.'s plant in Nijmegen, the Netherlands, was named assistant manager there. He joined the company in 1942 and became supervising engineer of lift truck design in Portland, Oreg., headquarters of the firm.

Paul H. H. Hookings, chairman of the British Columbia Chapter of the AFS for the current year, since 1952 has been plant manager, Major Aluminum Products Ltd., Vancouver, B. C. He was graduated from University of British Columbia, where he later did postgraduate work in metallurgy. As an undergraduate he worked in the foundry and laboratories of Consolidated Mining & Smelting Co. of Canada Ltd., Trail, B. C. Prior to joining Major Aluminum he was metallurgical research assistant, British Columbia Research Council.

D. Frank Mederos was named vice president and assistant to the president, Walworth Co. He attended Northeastern University and Massachusetts Institute of Technology and joined Walworth Co. 35 years ago. Mr. Mederos will continue to have charge of Canadian sales and to direct the Eastern division and Boston branch sales. His headquarters will be in Boston but he will spend considerable time at company headquarters in New York on special assignments.

Arthur M. Kiely, vice president and a director, Buffalo Forge Co., Buffalo, was also elected treasurer of the company, a position previously held by **Edgar F. Wendt,** president. Mr. Kiely has been with the company since 1930.

Vincent V. Tivy has been appointed chief application engineer, Foxboro Co., Foxboro, Mass.

Robert K. Beck has resigned as president and director, Apex Smelting Co., Chicago. **Louis Lippa,** who has been in management and a director of the company since it was founded, has succeeded Mr. Beck as president.

H. F. Vogt, since 1949 chairman of the board of directors, Cutler-Hammer Inc., Milwaukee, recently resigned, after 56 years of active service. He will continue as a director. **G. S. Crane,** since 1945, president and chief executive officer, succeeds Mr. Vogt. Mr. Crane became a director in 1931, and vice president-sales and engineering in 1939. **Philip Ryan** was elected president and chief executive officer. He became vice president-manufacturing and development engineering in 1951. **J. C. Borden,** since 1947 controller, was elected vice president-controller.

Gordon I. Lindsay has retired as president and director, Robeson Process Co., New York. For the past 37 years Mr. Lindsay has been chief executive of the 50-year-old company whose products include liquid and dry binders for core work, sand facings and sprays. He was a pioneer in the development and sale of by-products produced from the sulphite liquors discharged by pulp mills.

B. H. Sullivan Jr. was appointed assistant vice president, Magnus Metal Corp., Chicago, subsidiary of National Lead Co., New York. Mr. Sullivan joined the Chicago sales staff of Magnus Metal in 1952. He will

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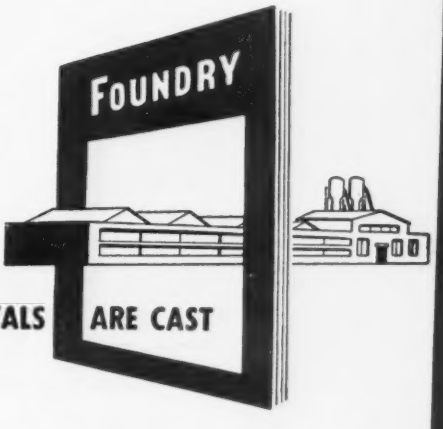

Serving Foundrymen

WHEREVER METALS ARE CAST

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E. C. TINSLEY
. . . Mexico Refractories v. p.

HALFRED F. RANDOLPH
. . . becomes division mgr.

HARLAN T. PIERPONT
. . . Norton refractories

FRED L. CURTIS
. . . new products, Norton Co.

assist in handling western sales. **J. J. Croft** was appointed St. Louis district sales manager and **L. J. Gruber** was transferred from Cincinnati to Chicago sales.

E. C. Tinsley was recently appointed vice president-refractory specialties, Mexico Refractories Co., Mexico, Mo. He joined the company in 1935. **Halfred F. Randolph,** since 1953 assistant manager, is manager of the refractory specialties division. Mr. Randolph has been with the company since 1941.

R. James Wilson, Bala-Cynwyd, Pa., was appointed sales engineering representative, Aurora Metal Co., Aurora, Ill., to cover Delaware, Maryland, eastern Pennsylvania and southern New Jersey.

Jack L. Blough has joined Foundries Materials Co., Coldwater, Mich., as sales engineer. He was formerly supervisor of metallurgical, sand, and quality control, E. W. Bliss Co., Hastings, Mich.

Fred W. Burgie was named assistant general sales manager, Doehler-Jarvis Division, National Lead Co., New York. **Charles I. Hodgson** has succeeded Mr. Burgie as manager of sales of the two Toledo, O., plants. **John W. Thees,** who for two years has been acting plant manager of the Toledo plants, has been named manager of Toledo Plant No. 1. **Kenneth F. Kroegler,** formerly works manager of Toledo Plant No. 2, was named manager there. **Robert H. Mayer,** who has been acting plant manager, was named plant manager of the Grand Rapids, Mich., plant.

Grant S. Diamond, president, Electro Refractories & Abrasives Corp., Buffalo, was elected president for 1956 of the Grinding Wheel Institute, Cleveland, succeeding **Clarence E. Etheridge,** Macklin Co., Jackson, Mich.

Donald L. Price was appointed sales manager of grinding wheels, Abrasive Division, Norton Co., Worcester, Mass. Other sales managers appointed by the division include: **George A. Park,** abrasives; **Harlan T. Pierpont,** refractories; and **Fred L. Curtis,** new products. Mr. Price, who joined Norton in 1920, has been a sales manager in regional and national capacities since 1949. Mr. Park, formerly manager of distributor sales, joined the research laboratories in 1910. Mr. Pierpont became a company abrasive engineer in 1937. Mr. Curtis, for the past year an assistant sales manager, became an abrasive engineer for Norton in 1929.

William H. Depperman was appointed director of public relations, Link-Belt Co., Chicago. He was formerly public relations director, Olin Industries Inc., East Alton, Ill. **Harlan B. Collins,** secretary of Link-Belt Co., will assist Mr. Depperman in his new position.

Naaman H. Keyser has been named chairman of the Central Ohio Chapter of the AFS for the current year. Since 1941 he has been asso-

JACK L. BLOUGH
. . . foundry sales engineer

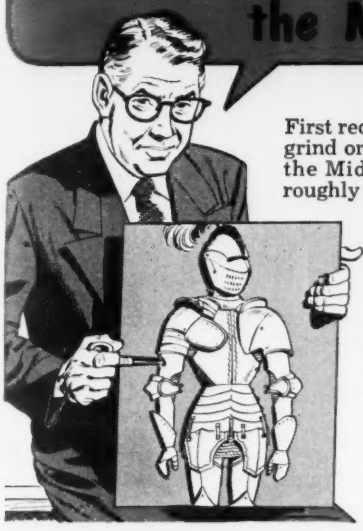
DONALD L. PRICE
. . . grinding wheel sales mgr.

GEORGE A. PARK
. . . sales mgr., abrasives

NAAMAN H. KEYSER
. . . heads AFS Chapter

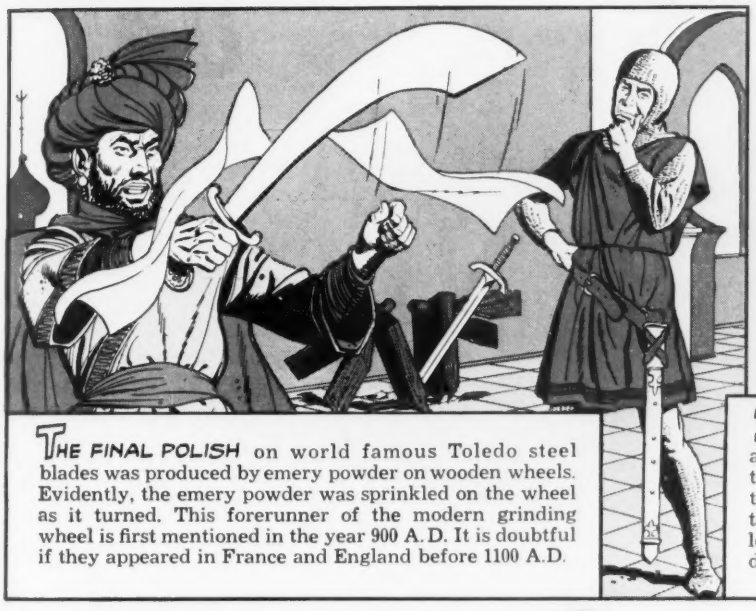
NO. 6 OF A SERIES
ON THE HISTORY OF ABRASIVES
BY CHICAGO WHEEL & MFG. CO.

THE FORERUNNER of the MODERN GRINDING WHEEL appears in the Middle Ages.

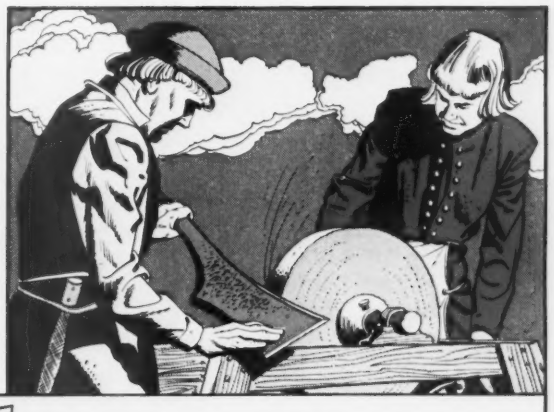


First records of a wheel used to grind or polish metal appear in the Middle Ages—the period roughly between 800 and 1400 A.D. Metal-working reached artistic heights in Europe during this period, particularly in the use of iron and steel for armor. Gold and silversmiths also produced striking examples of their art during this time.

EUROPEAN HISTORY is not specific about the introduction of the vertical wheel for grinding. Many historians believe it originated in the Orient as early as the 3rd century and filtered into Europe during the Crusades, or with the Moorish invasion of Spain. It is known that the blades of the Moors were amazingly sharp, indicating a finish that couldn't have been given them with the forger's hammer or by hand abrading.



THE FINAL POLISH on world famous Toledo steel blades was produced by emery powder on wooden wheels. Evidently, the emery powder was sprinkled on the wheel as it turned. This forerunner of the modern grinding wheel is first mentioned in the year 900 A.D. It is doubtful if they appeared in France and England before 1100 A.D.



IN ENGLAND at the turn of the 14th century, there are a number of references to "grindstones," one in particular mentioning the "grindstone with an iron-axle tree." Because of the coarseness and irregularities in the grain of the stone, it is believed these were used for less exacting metal grinding, the fine work still being done by hand.

ABOUT THE YEAR 1450 chain mail combined with steel plate gave way to entire suits of plate armor. These are magnificent examples of metal-working, representing the highest skill attained by man in working steel without machinery. The brilliant satin finish on the metal was brought out by burnishing with emery and pumice. The suits were made mobile by clever fitting of metal to metal, ground to exacting tolerances.

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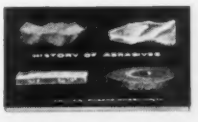

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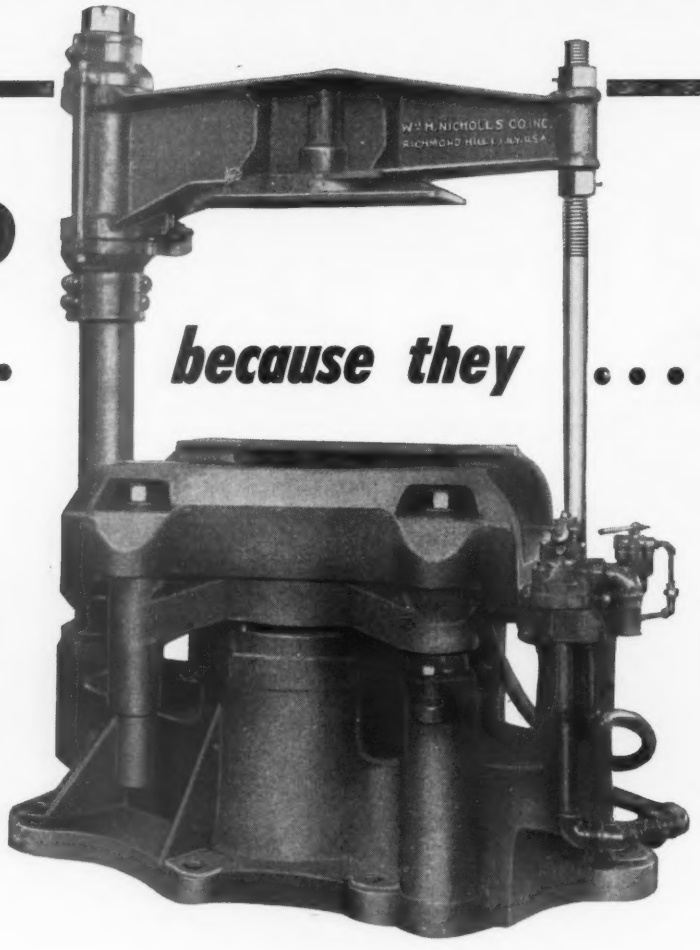

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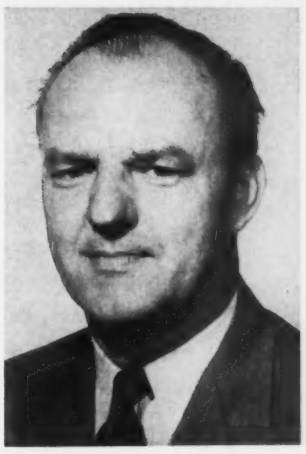
. . . Colorado representative

CHARLES M. DICK JR.
. . . joins Metal & Thermit



A. P. ALEXANDER
. . . Mid-South Chapter head

ciated with Battelle Memorial Institute, Columbus, O., where he is now assistant chief of the process metallurgy division. A graduate of Antioch College, Mr. Keyser also has a master's degree from Ohio State University. Previously he was associated with Ohio Steel Foundry Co., Lima, O.

James R. Hewitt, chairman of the Texas Chapter of the AFS, is director of customer relations, Texas Foundries Inc., Lufkin, Tex. A graduate of Lehigh University, Mr. Hewitt was associated with Republic Steel Corp. in Youngstown, O., and South Chicago, Ill., until 1935, when he joined American Manganese Steel Division, American Brake Shoe Co., Chicago Hgts., Ill. Moving to Texas he was president, Hewitt-McGrail Co., Houston, until last year when he joined Texas Foundries.

Charles H. Luikart, formerly manager of the Boston office, Kaiser Aluminum & Chemical Corp., Oakland, Calif., was appointed assistant district sales manager of the Cleveland district office. He has been with the company since 1947. **Carl Snider** has been transferred to Detroit, where he will represent the Chemicals Division in Michigan and northwest Ohio. He joined Kaiser in 1951. **Murray Schmidt** has succeeded Mr. Snider as division sales engineer in Oakland, Calif. **Samuel T. Johnston** has joined the division as salesman in Tennessee, Mississippi, Alabama, North and South Carolina, Georgia and Florida, with headquarters in Birmingham.

Neal J. Crain, since 1951 director of purchases, United Engineering & Foundry Co., Pittsburgh, was recently elected vice president-purchases.

Gordon Ley has been appointed Colorado representative of a new district established in Denver by Electric Steel Foundry Co., Portland, Oreg. With the company 15 years, for the past six he was an engineer specializing in ore processing equipment. **Garland Allen,** who for 3 years managed the Utah-Colorado territory from Salt Lake City, will now devote full time to the Utah and southern Idaho area.

Charles M. Dick Jr. recently joined Metal & Thermit Corp., New York, to direct its staff of sales engineers handling the Kel-Ray projectors for industrial radiography, manufactured by M. W. Kellogg Co., New York. A graduate of University of Alabama, Mr. Dick was formerly welding engineer, Todd Shipyards, Houston, Tex. **Francis A. Dales** will handle Kel-Ray sales in Atlanta, **William P. Hoppe,** in the San Francisco area, **Harold Mears** in Pittsburgh, and **Henry C. Opie**, in the Chicago area.

Robert W. Bruins was appointed manager of handler sales, the Colson Corp., Elyria, O., to direct sales of the company's line of industrial trucks. He was formerly general manager, Gilbert Mann Co., Cincinnati, representative for Towmotor Corp., Cleveland.

Henry Thompson, formerly associated with Triangle Finishing Corp., Johnstown, N. J., was recently appointed sales manager, Ra-Vac Inc., High Bridge, N. J., successor to Industrial Radiant Heat Corp., Gladstone, N. J.

William H. Redhead has been appointed Ohio sales representative for the Page Belting Co., Concord, N. H. His headquarters are at 2015 Richland Ave., Lakewood 7, O.

A. P. Alexander, chairman of the Mid-South Chapter of the AFS for the current year, is works metallurgist at the Memphis, Tenn., plant, International Harvester Co. Mr. Alexander attended Armour Institute of Technology and was graduated from University of Memphis. After metallurgical work at Frankford Arsenal, Philadelphia, during military service, he was foundry metallurgist at International Harvester's Chicago plant. Previously he was associated with Greenlee Foundry Co., Cicero, Ill., and International Nickel Co., New York.

B. P. Hammond has been named vice president of eastern casting sales, and **H. A. Forsberg,** vice president of western casting sales, Continental Foundry & Machine Division, Blaw-Knox Co., Pittsburgh. Messrs. Hammond and Forsberg were formerly vice presidents of Continental Foundry & Machine Co.

Paul R. Minich Jr. was named general sales manager, Materials Handling Division, Yale & Towne Mfg. Co., Philadelphia. He was formerly a Yale representative as president, Materials Handling Products Corp., Syracuse and Albany N. Y. **Joseph J. Murray,** until recently electric industrial truck sales manager, was appointed assistant general sales manager.

Robert J. Weiss was appointed grinding wheel sales representative in the Pittsburgh area, Electro Refractories & Abrasive Corp., Buffalo.

Everett M. Hicks, vice president and manager of the grinding machine division, Norton Co., Worcester, Mass., was named to serve as a member of the Machine Tool Manu-

DONALD E. WEBSTER
. . . Rochester Chapter head

C. H. WILLS
. . . new products development

W. S. HOSKIN
. . . general sales mgr.

CHARLES W. MOONEY JR.
. . . Philadelphia Chapter head

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Donald E. Webster, chairman of the Rochester Chapter of the AFS for the current year, is superintendent of the foundry division, American Laundry Machinery Co., Rochester, N. Y. For 6 years after graduation from Rochester Institute of Technology he was associated with Whitehead Brothers Co.'s laboratory in Rochester. In 1929 he joined American Laundry Machinery Co. as chemist and metallurgist, becoming foundry superintendent last year.

Charles D. Preusch, currently chairman of the Metropolitan Chapter of the AFS, is foundry metallurgist, Crucible Steel Co. of America, Harrison, N. J. Since graduation from Columbia University his work has centered around metallurgical production, process development, and research in connection with production of wrought and cast products, including experience with a wide variety of mold making processes. Mr. Preusch was vice chairman of the Metropolitan Chapter last year.

C. H. Wills was appointed vice president in charge of developing new products and adaptations of present products, Michigan Abrasive Co., Detroit. Mr. Wills was formerly vice president-sales. **W. S. Hoskin,** active in the abrasive field since 1934, was named general sales manager, and **Morgan Burt** continues as sales manager.

James O. Ochsner, elected chairman of the Central New York Chapter of the AFS for the current year, was graduated from Clarkson College. Since 1940 he has been a technical assistant in Crouse-Hinds Co.'s foundry, Syracuse, N. Y. Mr. Ochsner served as vice chairman of Central New York Chapter last year.

H. H. Blosjo, elected chairman of the Twin City Chapter of the AFS for the current year, has been chief chemist, Minneapolis Electric Steel Castings Co., Minneapolis, since 1930. A graduate of University of Minnesota, he did graduate work in metallurgy there later. From 1928 to 1930 he was chief chemist, Minneapolis Moline Power Implement Co. Mr. Blosjo was vice chairman of Twin City Chapter last year.

Charles W. Mooney Jr., recently elected chairman of the Philadelphia Chapter of the AFS for the current year, is superintendent of the Olney Foundry, Link-Belt Co., Philadelphia. He attended Temple University and Pennsylvania State University and joined the Olney foundry in 1934, where he was assistant superintendent from 1946 until early last year.

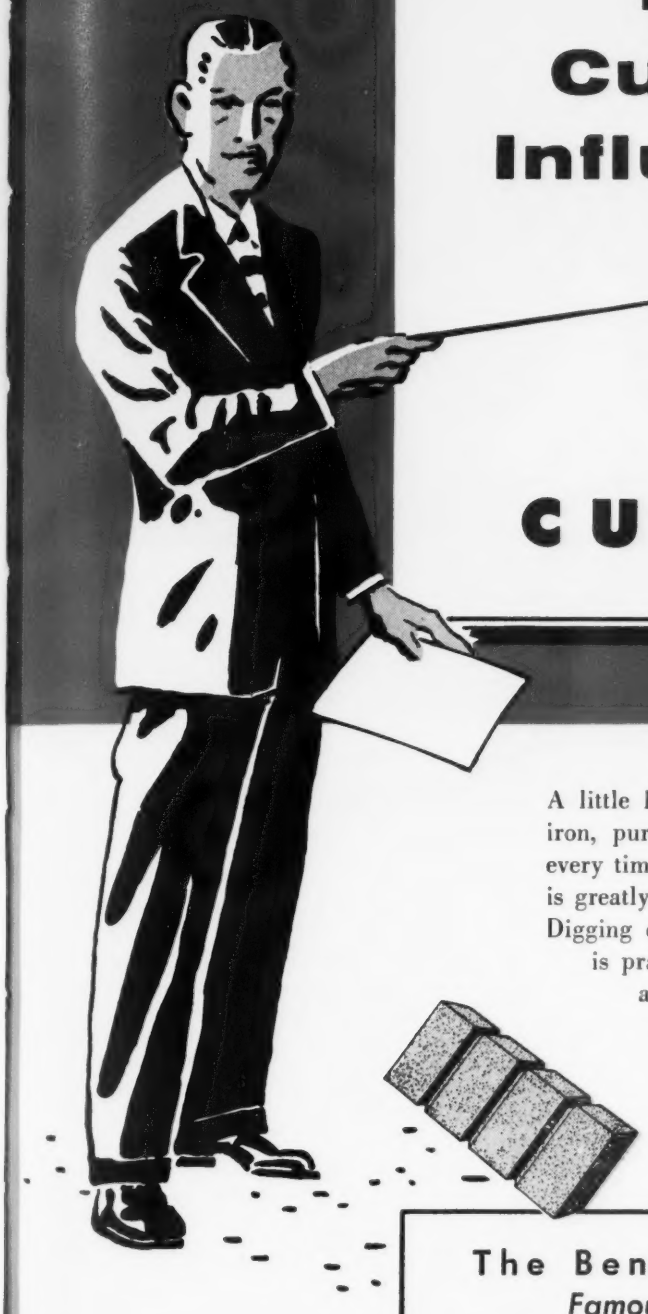
John D. Sheley, elected chairman of the Cincinnati Chapter of the AFS for the current year, since 1951 has been assistant works manager, Black-Clawson Co., Hamilton, O. A graduate of Purdue University, he joined the company in 1947 as metallurgist, becoming chief metallurgist in 1949.

CHARLES D. PREUSCH
. . . AFS Chapter Chairman

JAMES O. OCHSNER
. . . AFS Chapter Chairman

H. H. BLOSJO
. . . AFS Chapter Chairman

JOHN D. SHELEY
. . . heads Cincinnati Chapter



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Forms a perfect covering over the metal during melting, prevents oxidation and reduces obnoxious gases to a great extent.
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Fig. 1 (above)—Direct reading spectrograph used for quick checks of contents of cast iron samples

Fig. 2 (right)—Induction heating machine is used to determine the carbon content of cast iron chips

Rapid Sampling Helps in

Maintaining Iron Quality

By G. B. KINER
Works Metallurgist
International Harvester Co.
Milwaukee

IRON having high steel content in the charge is cast in large quantities in the foundry of International Harvester's Milwaukee Works. Uniformity in the quality of castings is important because scrap losses can be reduced and troubles in machining can be minimized when optimum quality is maintained.

Until recently, dependence was placed largely on visual examination of fractures in test chill blocks 6 in. long and having a hollow triangular section. These specimens were cast four times a day in core sand and were quenched. Composition was considered satisfactory if the break occurred in areas of specified thickness. Laboratory analyses were made but since they required about 24 hours to complete, the heats checked had to be poured long before test results were known. Consequently, the results could serve only as a guide in preparing future heats.

These circumstances led to the purchase of a Baird direct-reading spectrograph. It has been installed in an air-conditioned room in a laboratory near the foundry and can provide the necessary checks on analyses of the iron poured into test samples within a ten-minute period. This makes it possible to correct the cupola metal before pouring is done.

As a result of these tests, and those made simultaneously on a Leco carbon determination unit, it has been possible to hold much closer control on the quality of iron cast. This reduces scrap and helps to produce castings having uniform machining properties. Tool wear is reduced in machining and this lowers the down time for machines, with corresponding increase in their daily output.

Samples like those in the accompanying illustration are supplied every half-hour from each of two cupolas running what is known as No. 93 iron having high steel content. As soon as results are available, they are phoned to the foundry, which makes immediately such changes at the cupola as will keep the metal uniform.

Although the spectrograph can check quickly for all elements present in the sample, the checks recorded are on silicon, copper, nickel,

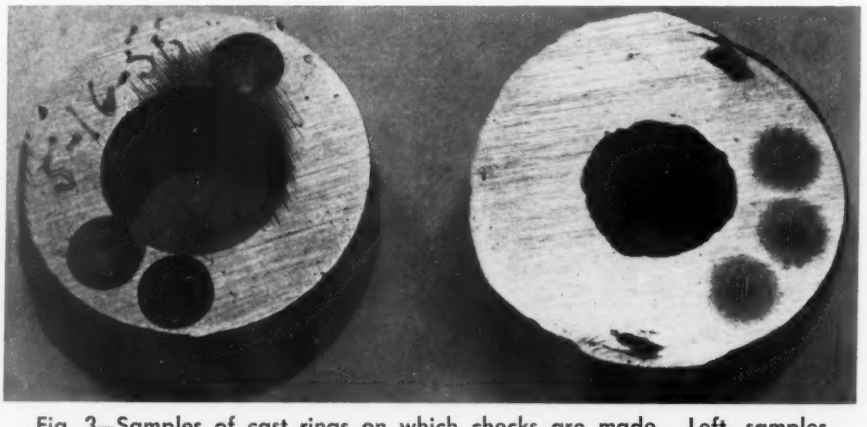

Fig. 3—Samples of cast rings on which checks are made. Left, samples for carbon determination were taken from unchilled side of the ring. On the right is chilled side, which has been checked by the spectrograph

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The "Blue Chip" Metal Abrasive

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says Nelson Hartley

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assures the molder a constant sand supply.

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The original manufacturer of automatic controls for sand systems.

chromium and molybdenum. Carbon also is important but is checked to better advantage by using the Leco induction heating unit. A small crucible containing the sample in chip form is heated in the induction coil in an oxygen atmosphere and, as the heating time is short, precise results are obtained quickly. Chips are taken from the soft side of the ring, at the left in Fig. 3.

Samples for checking in the spectrograph are cast with a chill on one side, and this side is exposed to the arc in the spectrograph. Use of a chilled sample gives uniformity and yields results that are reproduced regularly. Besides use in checking the content of cast iron, the spectrograph is employed also for checking samples of steel from departments other than the foundry and also for checks on nonferrous alloys. Hence the utility of the instrument is not confined to determinations on cast iron.

Molding Sands Discussed in Series of 12 Bulletins

Up-to-date data on foundry molding problems and techniques are available in *How to Improve Molding Sands*, a series of reports prepared by Illinois Clay Products Co., Joliet, Ill. These reports cover subjects ranging from analysis and comparison of foundry clays to the proper sand for the production of saleable gray iron castings.

Prepared by an authority in the field, they offer well organized, easy-to-follow outlines of information useful for a variety of purposes. Titles of the first 12 in the series include the following:

1. "A Comparative Study of Bonding Clays." 2. "What Does Seacoal Do for Molding Sands?" 3. "The Action of Stabilizers." 4. "Gating and Feeding Castings." 5. "Effect of Varying Clay Contents." 6. "How Clay Bonds Affect Moldability." 7. "Measuring Compressibility of Molding Sands." 8. "Advantages of Bond Clay Combinations." 9. "Molding Sands of the United States." 10. "Molding Sands for Light and Medium Weight Gray Iron Castings." 11. "Special Malleable Foundry Bulletin." 12. "Special Nonferrous Foundry Bulletin."

These reports are available to foundry superintendents, metallurgists, foremen and other, similarly qualified foundry personnel. For copies, write on your company letterhead to Illinois Clay Products Co., 208 South LaSalle St., Chicago 4.

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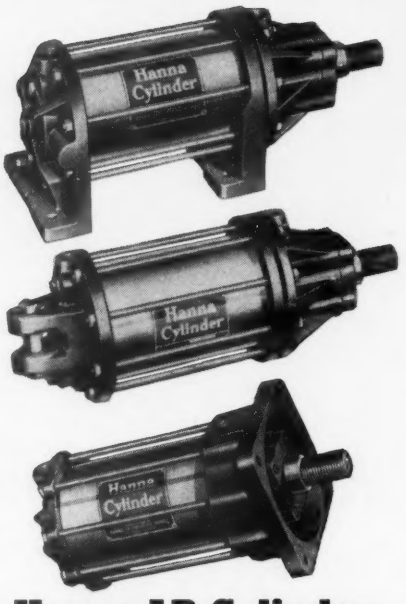

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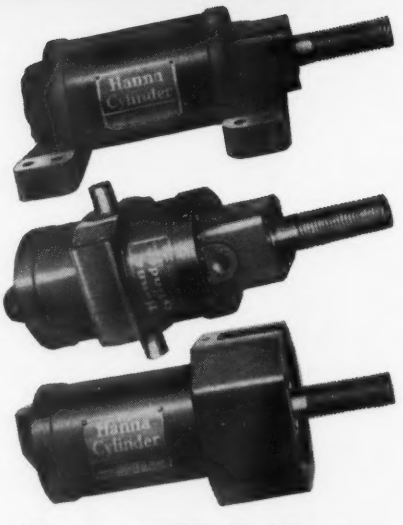

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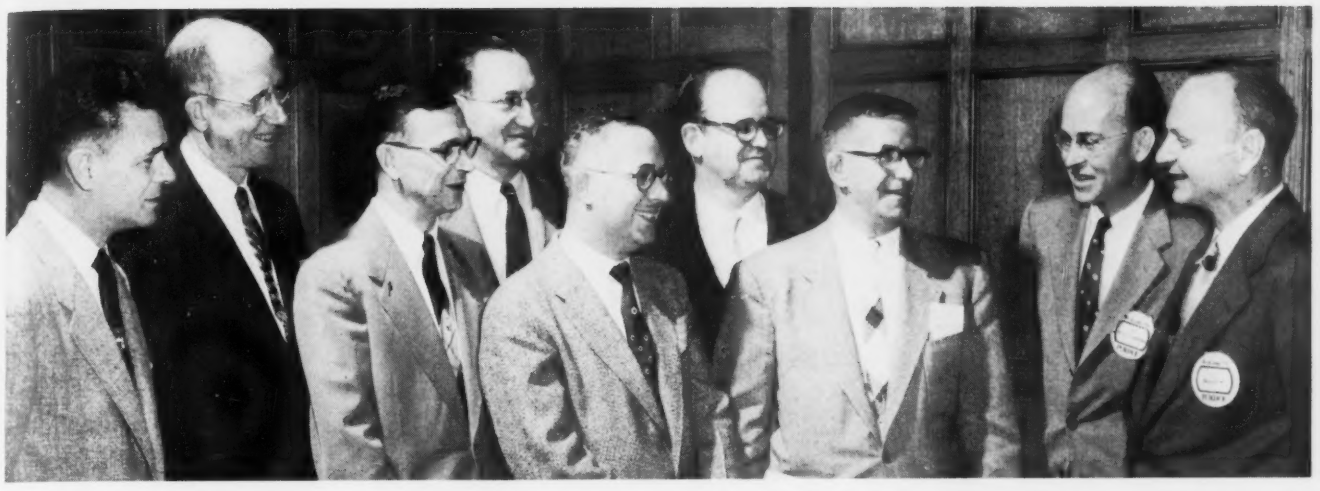


Left to right, R. H. Greenlee, Auto Specialties Mfg. Co., program chairman; J. P. Lentz, International Harvester Co., the conference chairman; Victor J. Obrig, Fabricast Division, General Motors Corp., assistant program chairman; Howard B. Voorhees, Buckeye Products Co.; James C. Maggart, Sibley Machine & Foundry Co.; Stephen Taylor, Electric Steel Castings Co.; Carl Schopp, Link-Belt Co.; R. Schuhmann Jr., Purdue University; and C. T. Marek, Purdue University

Purdue Holds Eighth

METALS CASTING CONFERENCE

By ERLE F. ROSS
Chicago Editor

A PROGRAM that started off on humanics and wound up on molding sands—and along the way took a look at politics—featured the Metals Casting Conference at Purdue University, West Lafayette, Ind., Nov. 3-4. It was the eighth annual event sponsored by the university's School of Chemical and Metallurgical Engineering and Division of Adult Education, and the Michiana and Central Indiana Chapters of the American Foundrymen's Association.

Registered attendance was approximately 190, but participation was swelled by some 150 students. During each of five sessions, scheduled foundry classes were dismissed to permit about 30 students to listen to conference speakers.

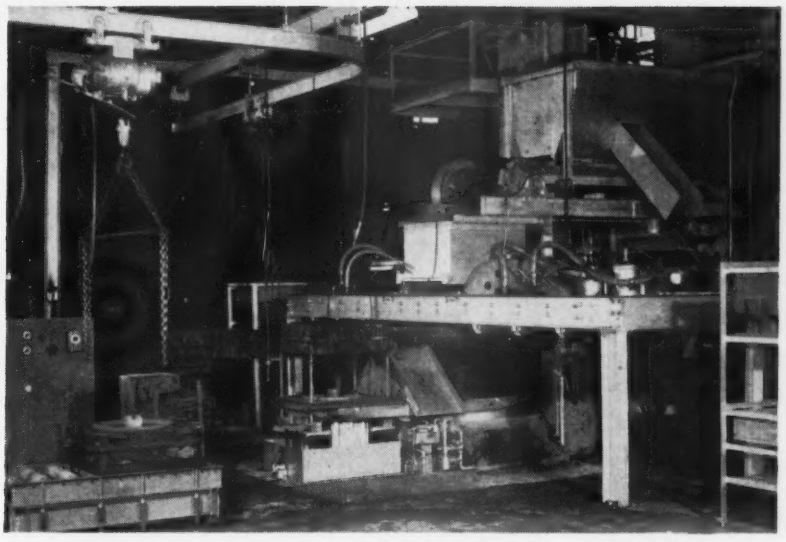
Scientific advancements stimulate intensive effort to apply research developments to industrial processes. The foundryman is increasingly aware of the role of science in industry. Consequently, purpose of the conference was to present speakers with specialized interests and backgrounds who could instruct and advise foundrymen in new and better ways of castings production.

Conference chairman was J. P. Lentz, assistant works manager, International Harvester Co., Indianapolis. R. H. Greenlee, plant superintendent, Auto Specialties Mfg. Co.,

At the conference, left to right, are Frank T. Shipley, Caterpillar Tractor Co., vice president of the AFS; Mr. Greenlee, Mr. Lentz and Mr. Marek

Dr. M. B. Ogle Jr., Purdue University, right, was the speaker at the conference banquet, and Dr. Schuhmann acted as toastmster for the occasion

THE HERMAN PNEUMATIC MACHINE CO., UNION BANK BUILDING, PITTSBURGH 22, PA.



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In this respect it is a tradition with Herman to lead the way.

For example, in St. Paul, Minnesota the American Hoist & Derrick Company recently installed the new Herman Stationmaster illustrated on the right. (It's an automatic, two station, indexing type jolt, squeeze, strip machine.)

This Herman machine should be amortized in just ONE YEAR. It has increased planned production of 300 half molds per shift to over 500 within the first three months of operation — despite daily requirements for 25 pattern changes per shift. With this increased production only three men are required to handle every operation in the molding cycle preliminary to pouring.

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St. Joseph, Mich., was program chairman, with Carl O. Schopp, assistant general superintendent, Link-Belt Co., Indianapolis, as assistant chairman.

Committee members included K. E. Glancy, conference supervisor, Division of Adult Education, Purdue; R. W. Lindley, professor of industrial engineering, Purdue; J. C. Maggart, shell molding supervisor, Sibley Machine & Foundry Co., Mishawaka, Ind.; C. T. Marek, professor of metal processing, Purdue; Victor J. Obrig, chief metallurgist, Fabricast Division, General Motors Corp., Bedford, Ind.; W. E. Patterson, president, Elkhart Foundry & Machine Co., Elkhart, Ind.; R. Schuhmann Jr., professor of metallurgical engineering, Purdue; Stephen S. Taylor, metallurgist, Electric Steel Castings Co., Indianapolis; and H. B. Voorhees, sales eengineer, Buckeye Products Co., Mishawaka, Ind.

Industry Trends Affect Education

Presiding at the opening session Dr. Schuhmann introduced Dr. Albert R. Spalding, department head of freshman engineering, who in a welcoming address mentioned the impact which trends in industry are exerting on engineering education. Rise in power consumption which has doubled in ten years will probably continue. Automation is being applied in many fields and product design has become very exacting as the result of higher pressures and temperatures employed. As a result, Dr. Spalding stressed that the demand for scientists and engineers is up. Continuing, he emphasized that the problems of tomorrow are going to challenge the best minds in technical fields. This means that current trends will influence education in four ways: Supply better trained scientists and engineers; require more technicians to assist scientists and engineers; continue education and conference programs; expand educational research programs.

Frank W. Shipley, Caterpillar Tractor Co., Peoria, Ill., and national vice president of the American Foundrymen's Society, addressed the conference, complimenting the university and AFS chapters on sponsoring of the eight conferences, which he said supplement the annual conventions. It is through contacts with others and interchange of information and ideas that progress is achieved, he said.

Ralph L. Lee, in his own inimitable style, reviewed "Fundamentals of Humanics," emphasizing leadership as his theme. He commended the idea of promoting a good worker to supervisory capacity. Some men feel unable to lead others but he insisted that one can't be a good leader unless he has been a good follower. He outlined elements of good leadership and

For smoother shell molds

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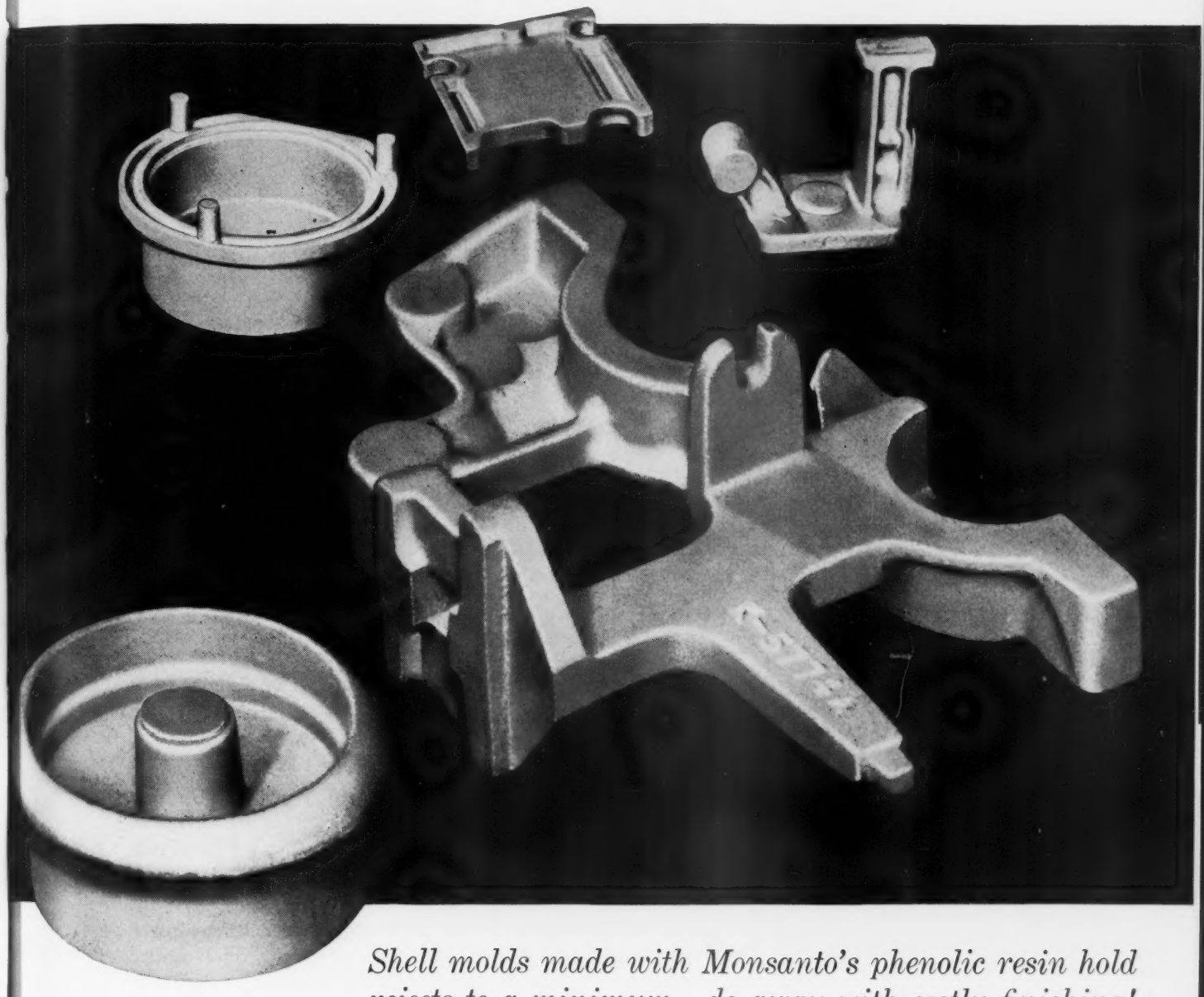

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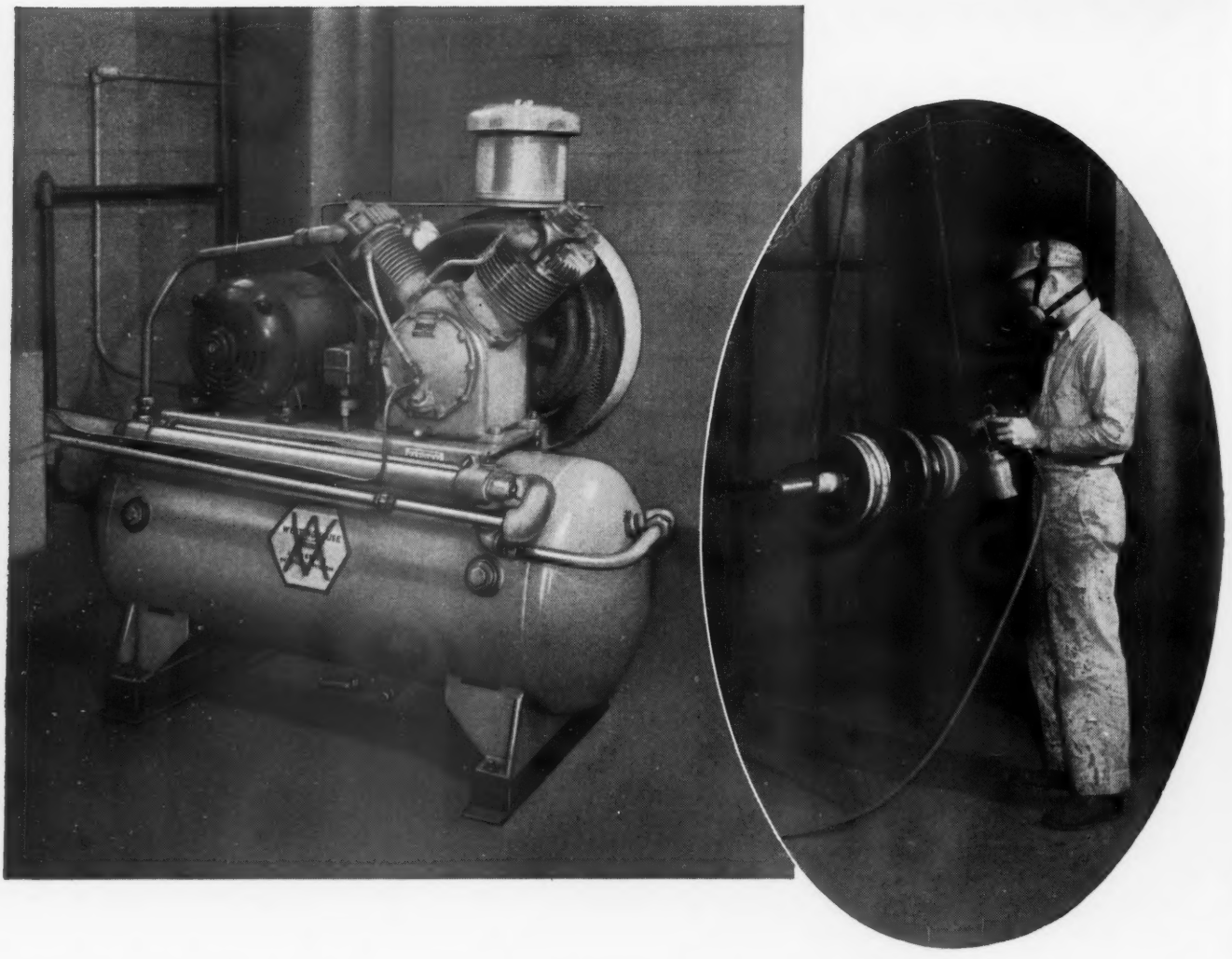

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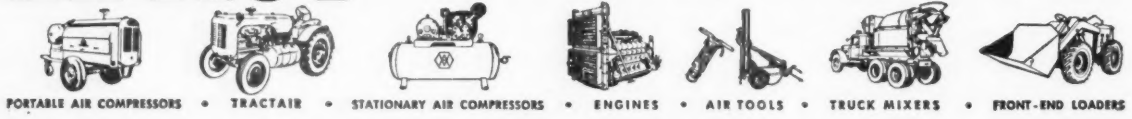

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said successful leaders have found a reason for living.

He ended with the thought that we are leaving the age of mechanics and entering the age of humanics.

On Thursday afternoon, O. J. Myers, Archer-Daniels-Midland Co., Minneapolis, outlined accomplishments of the AFS Sand Committee, which he heads. Chairman of the meeting was Stephen S. Taylor, Electric Steel Castings Co., Indianapolis. Mr. Myers urged foundrymen to take advantage of the society's expansive sand knowledge. Much additional research needs to be done and he invited all to participate. West Coast foundries are re-arousing interest in sand testing, and plan comparisons with Midwestern sands.

Discusses Gases in Metal

Prof. C. T. Marek conducted the second part of the session at which Dr. Norman Parlee of the Chemical and Metallurgical Engineering School, discussed "Gases in Metals." He cited the troublesome gases which get into metal through ore in smelting, melting and heating operations and discussed solubility laws as they apply to molten metals. Some alloying elements increase solubility while others decrease it. Dr. Parlee feels that nitrogen is more responsible than hydrogen for porosity in cast iron and believes research along this line should be developed.

At the banquet held Thursday evening 28 students enrolled in the Foundry Educational Foundation program were guests of the conference. Dr. Schuhmann, toastmaster introduced Dr. M. B. Ogle Jr., head of the university's history, government and philosophy department, who discussed "People, Politics and America." He gave credit to the bi-partisan political setup, mentioning the part which pressure groups play, and stating that our system of government seems secure as long as we are able to compromise on issues. The danger lies when political parties and people cannot compromise.

W. E. Patterson, Elkhart Foundry & Machine Co., Elkhart, Ind., presided at the Friday morning session. Charles F. Walton, technical director of the Gray Iron Founders' Society, Cleveland, gave an illustrated talk on "Principles of Risering." He discussed purpose of risering, contraction of metal, and emphasized that to feed a casting, a riser must stay liquid longer than the casting and must make sufficient liquid metal available. Proper shape of a good riser still needs to be determined.

Philip M. Semler, Auto Specialties Mfg. Co., St. Joseph, Mich., gave the second paper "Control of Metal in Melting." James C. Maggart, Sibley

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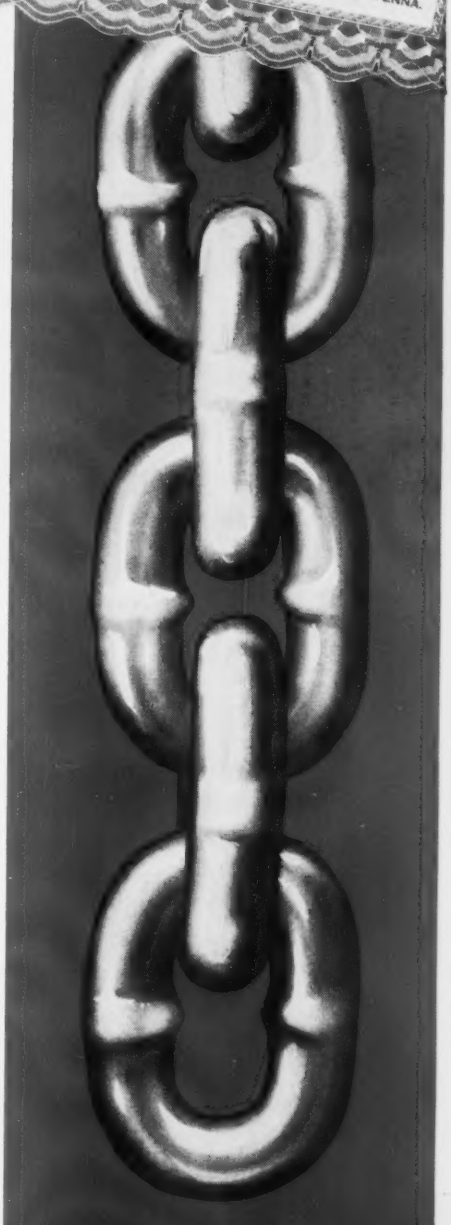

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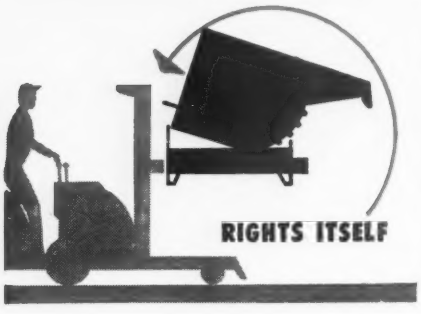

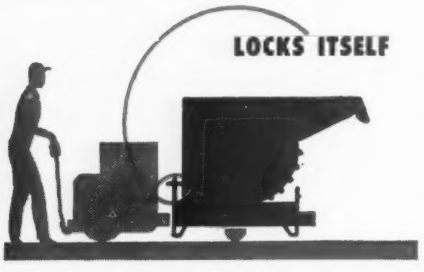

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Machine & Foundry Co., Mishawaka, Ind., was chairman of the second half of the meeting. Mr. Semler stressed importance of raw materials in quality control of metal. Scrap can cause a great deal of trouble. His company runs chemical analysis on scrap and he urged that pig iron, alloys and refractories should be purchased on specifications to meet melting requirements. He suggested that hot blast and humidity control units are economical, reducing coke consumption and improving metal quality. He concluded by stressing need for trained personnel.

At the concluding session of the conference, Earl E. Woodliff, Foundry Sand Service Engineering Co., Detroit, discussed "Molding Sands," with Howard B. Voorhees, Buckeye Products Co., Mishawaka, Ind., as chairman.

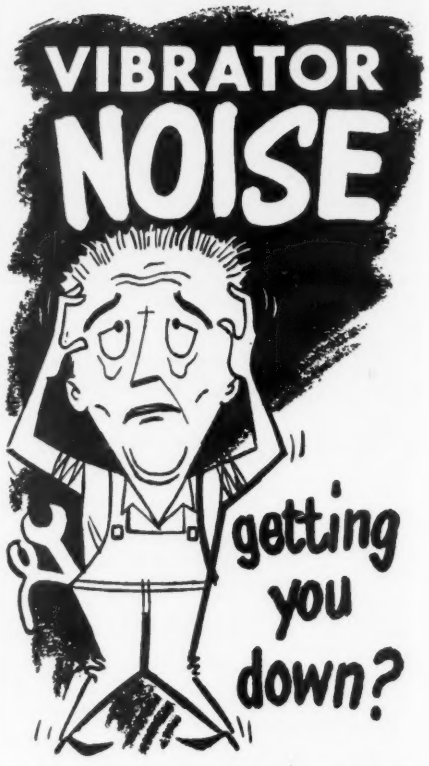
The speaker stated that sand control can be regarded as a great advancement in foundry practice. However, mechanical handling of sand has introduced new problems. Elimination of riddling results in insufficient aeration, removal of fines has certain disadvantages, and frequently tempering is inadequate. Aids in sand control were cited. Mr. Woodliff recommended that a responsible man be put at the muller, that all handling equipment be cleaned and properly maintained, and that additions to sands be measured on a percentage by weight basis. He suggested that binder be thoroughly blended before use and molding machines be checked before sand is blamed for poor castings. Mr. Woodliff feels that thermal expansion of sand is the principal cause of casting defects; therefore, the purpose of additives is to stabilize sand.

Offers Quality Control Course

Ninth annual short course in "Quality Control by Statistical Methods" will be offered May 19 through May 29, 1956, by the College of Engineering, University of Illinois, Urbana, Ill., with the co-operation of the Division of Engineering Extension at Urbana.

Intensive work will be given in the fields of control charts and acceptance sampling, with some attention to rational setting of specifications and tolerances. The course is designed for persons in the areas of design, production, procurement, management, quality control and inspection.

For further information, write to Prof. John A. Henry, Mechanical Engineering Laboratory, University of Illinois, Urbana.



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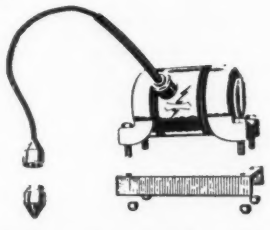

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Dear Reader:

***** HERE'S TO YOU and a great year of satisfying, rewarding accomplishment in the New Year!

You closed 1955 with a year of banner production -- which may well "add up" to be the second highest production year in foundry history (18,500,000 net tons).

We hit 19,200,000 tons in 1951.

Everyone seems to think that this will be another GOOD foundry year -- with production for the first half continuing at current high rates.

Come what may, FOUNDRY will bring you lots of interesting, helpful reading. These feature stories are scheduled for appearance in an early issue:

PRESSURE MOLDING -- Tom Barlow is the author and the subject will be discussed in terms of developments to date, sand used and how it differs from other synthetic sand. Will also outline the possibilities of high-speed production in cured molds made under high-pressure squeeze.

CAST BORON STEEL -- special study by Messrs. Gertsman, Faurschou and Buhr of Canadian Department of Mines and Technical Services -- tensile and impact properties of low-carbon boron steel in normal and drawn condition -- effect of rare earth additions.

INCENTIVE SYSTEMS -- a "how to establish" story with discussion of advantages by John Carter, Gray Iron Founders' Society.

DIE CASTING ALLOYS -- by M. R. Tebenbaum, Lester-Phoenix, Inc. gives recommendations for the selection of correct alloys and proper melting.

***** FAME AND FORTUNE AWAIT YOU! For several years, Associate Editor Bob Herrmann has conducted a popular feature in FOUNDRY dealing with foundry "how-to-do-its." Question? What tricks of the trade do YOU have tucked away in your experience? As Bob says, "We'll pay $15 or more for each idea submitted and published!" Hurry, hurry, hurry -- refer to contents page 3 of this issue for location of this featurette, send yours to Bob -- he'll do the rest!

FOUNDRY

Higher Quality Castings Sought by

The Russian Foundry Industry

The Soviet charges its castings industry with inefficiency and technological backwardness. Construction of large, specialized foundries is planned as the Russians turn to such practices as shell molding, the carbon-dioxide process and nodular iron, meanwhile seeking better grades of coke for use in their cupolas

By CHARLES L. ADAMS

RUSSIA has charged that inefficiency and technological backwardness in the nation's foundries are seriously retarding Soviet efforts to overtake and surpass the West in the field of machinery production.

Many of the current difficulties, according to the Russian press, stem from the reluctance of foundry managers to adopt new methods for fear of losing output or of making mistakes during the changeover. But Soviet scientific-research institutes, the chemical industry and equipment suppliers are also being accused of contributing to foundry shortcomings.

The Communist party newspaper *Pravda* has demanded that machine builders pay more attention to foundry work to insure better quality castings which will need less machining and will reduce the need for metal-cutting tools.

"Experience shows that successful development of a machine-building industry depends in great measure on foundry progress," one report states. "Yet some ministries and plant directors mistakenly consider foundries of secondary importance—mere suppliers of billets rather than vital links in machine-manufacturing processes.

"On some matters foundries are left to shift for themselves. Machine shops and assembly shops treat them like stepchildren. Such an attitude lowers foundrymen's efficiency and has a negative influence on the whole machine-building industry.

"The lag in foundry production has had a particularly adverse effect on the building of new, light, durable, high-speed machinery. In making these units there has been an unjustifiable overexpenditure of metal and man-power and low quality of workmanship. Such conditions can no longer be tolerated."

To help remedy the situation, the Communist party's Central Committee (the USSR's top policy-making group) has ordered construction of large, specialized foundries in various parts of the nation. Supplied with the best equipment available, the new foundries will handle much of the work now being done in small, high-cost, under-mechanized shops. Meanwhile, a drive has been launched to improve efficiency at all existing foundries.

Pravda claims that despite admittedly serious difficulties, Russian foundries have improved their production technology considerably in recent years.

"Work on shell molding has begun," it says. "This will considerably simplify output of precise small steel and iron castings with clean surfaces.

"Use of rapid-drying mold and core mixes based on water glass and other binding agents has been mastered. These mixes permit radical reductions in mold and core drying time and in some cases eliminate it altogether. Special cheap core binding agents have been introduced which eliminate the need for using scarce materials made from vegetable oils and animal fats.

"Foundry workers have developed new means of obtaining high-strength cast iron, and some plants have organized production of iron castings as substitutes for steel ones. Die casting, which saves metal, has become common. New types of highly-productive equipment have been developed to facilitate heavy operations."

Pravda complained, however, that there is no special organization to handle general foundry problems. As a result, it declared, problems of casting technology, such as those created by introduction of high-strength iron, are not solved for long periods.

"It is known that high-strength iron is obtained by adding magnesium to ordinary cast iron. It approaches steel in strength and at the same time retains many of the advantages of ordinary iron as a structural material.

"However, high-strength iron has not found widespread application in our machine building, and we lag behind foreign countries. This situation can be blamed both on the conservatism of designers and the inability of foundry workers to ensure constant quality in high-strength iron."

B. Noskov, Stalin prize winner and master of technical sciences, recently reported that Soviet foundries are unable to get top-quality foundry coke for use in obtaining high-strength iron from cupola furnaces.

"It is well known," he said, "that foundry coke differs from blast furnace coke in its properties. But the USSR Ministry of Ferrous Metallurgy is not concerned about providing foundry coke instead of blast furnace coke since the former requires more time, special mixing and additional cost. Thus many foundries use coke that is high in sulphur content, with low-quality iron castings the result.

"Thermo-anthracite, a type of fuel for cupola furnaces which permits high-temperature smelting of pig iron, was tested more than 20 years

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NO EXPENSIVE PITS FOR INSTALLATION — new floor-level Preparator — only one small pit required for skiphoist bucket.

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HIGH CAPACITY—SMALL AREA—No sand system ever before available offers as high a capacity of thoroughly conditioned and mulled sand from as small a floor area — or at as low a cost.

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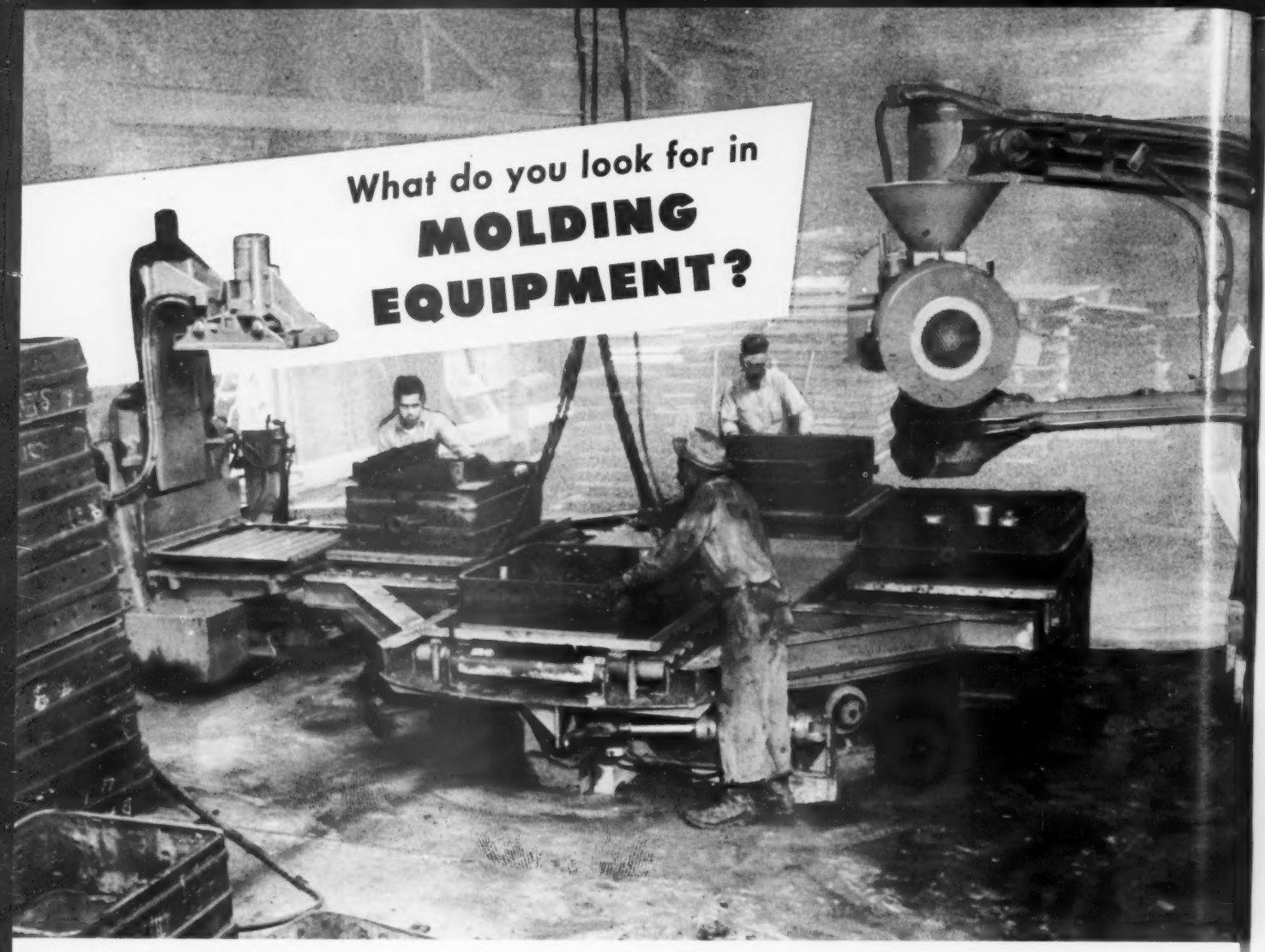
THE WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF FOUNDRY MACHINERY



IS IT RANGE AND FLEXIBILITY? There's more outright flexibility in these units than will ever be required — handles any size or shape of pattern that will fit on the table and rams one or a thousand molds from each pattern at equally low man-hour costs.

IS IT DEPENDABILITY? Rugged durable B & P construction marks every component of these units. It's in the Sandslinger or Hydra-Slinger, in the turntable, and in the fast accurate B & P Rol-A-Draw. There's a real assurance of lowest maintenance per ton of castings.

IS IT SPEED? No molding equipment can turn out large varied work faster. Here's all of the capacity that can be obtained from four large molding machines. Yet it's all combined in a single compact unit.

IS IT LOW OPERATING COST? Whether it's a four station, or eight station or an even larger unit, all operations can be handled by as few as three men. Here's a unit that will be profitable when operated at full capacity or partial capacity. Here's highest productivity per man-hour.

IS IT LOW INSTALLATION COST? Certainly no multiple molding machine installation can approach the low cost of an equally productive multiple station Slinger Roto-Mold unit.

One slinger does all the ramming, one rollover handles all of the molds. The result is more productive capacity for your equipment dollar.

IS IT SIMPLICITY OF INSTALLATION? Compare the ease and simplicity of delivering all the sand to a single station—of moving all rammed molds from a single station — to the sand delivering and mold handling problems of multiple machines. Then you'll see why these units are so widely accepted, so successfully used.

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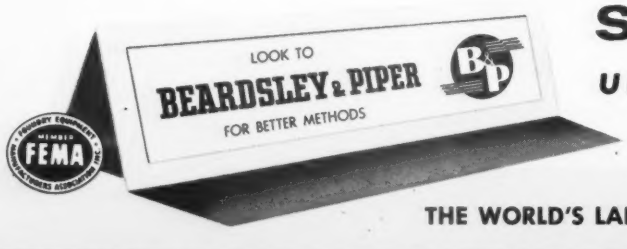

THE WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF FOUNDRY MACHINERY

ago but is being produced in entirely insufficient quantities. . . .

"An exceptionally effective means of reducing the sulphur content of pig iron smelted in cupola furnaces has frequently proved its worth in experimental installations. It involves changing cupolas over to basic lining. Even here, however, foundry workers face serious obstacles.

"Basic linings for cupola furnaces depend on chrome-magnesite brick, which is still in short supply and available to steel mills only. In this connection it should be remembered that Soviet refractories makers have developed means of producing a special so-called stabilized dolomite which fully meets the requirements of cupola furnace smelting.

"But although dolomite is cheap and plentiful in the Soviet Union, it is not being produced in a single plant of the refractories industry. Our foundry workers can only talk about cupola furnaces with basic lining and read material on foreign experience in this field."

Noskov said that while high-strength iron can be obtained by processing ordinary iron and adding magnesium, better and more constant results come from processing iron with an alloy of magnesium and silicon.

Wants High-Strength Iron

"Production of such alloys in foundries entails certain complications, although no such difficulties are involved in producing them at special magnesium-processing plants. But the Ministry of Nonferrous Metallurgy has not yet organized centralized production of magnesium-silicon alloys. Foundries either have to make these alloys themselves by crude methods or else use pure magnesium instead of alloys, thereby producing lower-quality iron."

The problem of improving the quality of cast iron by using so-called natural-alloy blast furnace pig irons containing chromium and nickel has also been handled poorly, according to Noskov. As a result, he declared, possibilities for obtaining castings with higher mechanical qualities are reduced, and opportunities for cutting the weight of machines are limited considerably.

"The same situation prevails regarding introduction of new, cheap, oil-free binding agents for mold and core mixtures.

"Binding agent 'P,' obtained in petroleum processing, is manufactured in entirely inadequate amounts and is available only to certain large

"What'sa matter with you guys — can't you make aluminum castings that don't leak?"

Big "leakers" from little pin-holes come.

How to overcome micro and pinhole porosity?

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This is only one of the research and service facilities offered to industry by our company. In addition to controlling our quality with the most modern techniques known, our Metallurgical staff is always at your service. They will be glad to consult with you on any problems related to non-ferrous metals. We can also develop and produce special alloys for any special requirements you may have.

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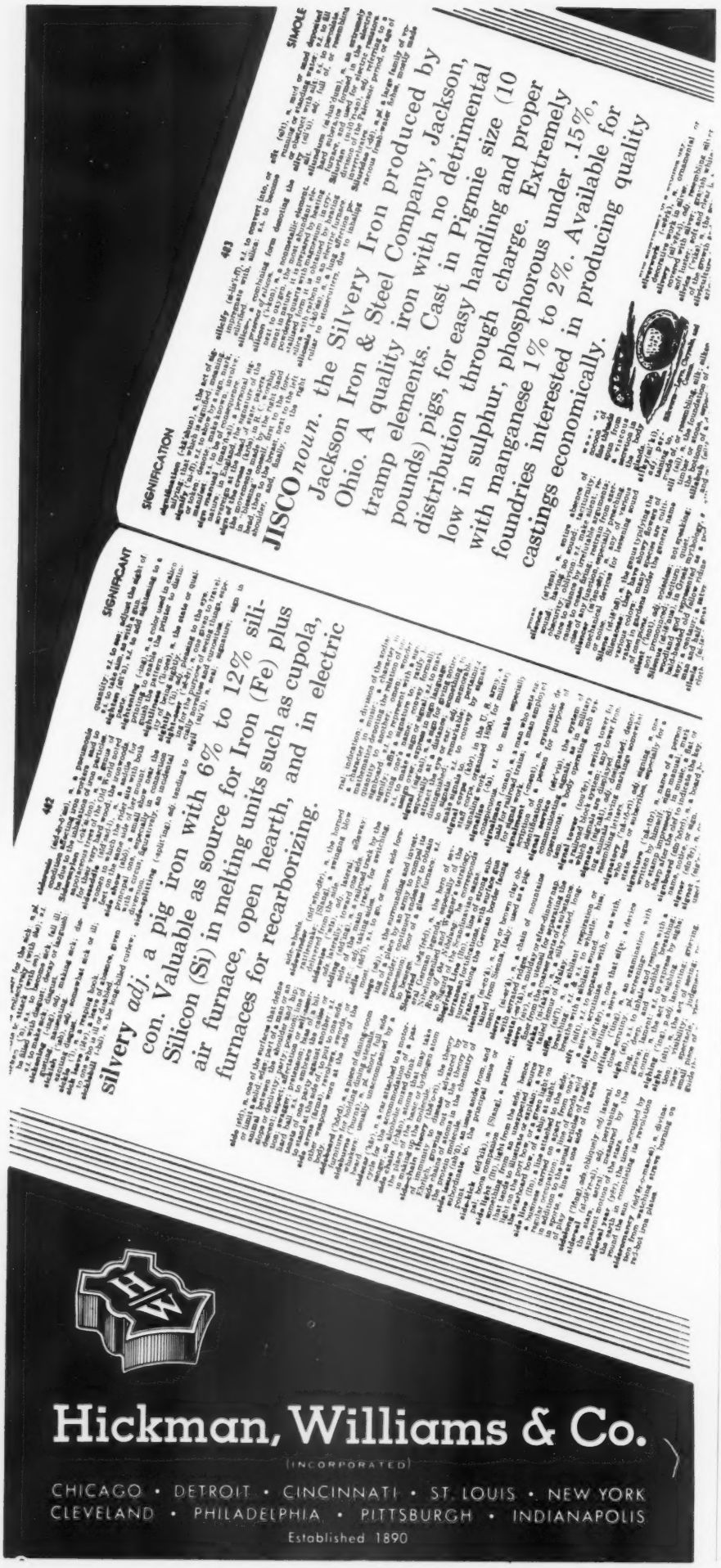
JISCO noun. the Silvery Iron produced by Jackson Iron & Steel Company, Jackson, Ohio. A quality iron with no detrimental tramp elements. Cast in Pigmie size (10 pounds) pigs, for easy handling and proper distribution through charge. Extremely low in sulphur, phosphorous under .15%, with manganese 1% to 2%. Available for foundries interested in producing quality castings economically.
silvery adj. a pig iron with 6% to 12% silicon (Si) in melting units such as cupola, air furnace, open hearth, and in electric furnaces for recarborizing.
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plants. The remarkable 'waterless core binder developed by the Stalin Automobile Plant in Moscow is not made at all by the chemical industry. Nobody has made provision for supplying foundries with such binding agents as shale tar and charcoal pitch.

"Widely-used water glass, which helps minimize steel casting rejects, is still in short supply. Ethyl silicate, the main binder now used for producing precision castings from investment molds, is very expensive; but the chemical industry isn't attempting to reduce the cost."

Noskov observed that widespread introduction of shell molding, "which is literally revolutionizing the entire technology of producing small castings," depends on the delivery of special resins to the foundries. These resins, he said, are both expensive and scarce; but the Ministry of the Chemical Industry still has not given any research institute the job of finding ways of producing them from cheaper and more readily available materials.

Distribution of Supplies Is Poor

The Russian technician also charged that there is poor organization in supplying foundries with such basic materials as molding sands, fireclay and scrap iron. He said that surveying and development of sand pits is lagging and that untreated sand is often used in production.

"Fireclay quarries of the USSR Ministry of Ferrous Metallurgy ply the refractory materials plants first of all, and only then do they deliver to the foundries. Scrap iron comes in without being sorted by types and size, and deliveries are irregular. Many foundries operate on a hand-to-mouth basis, taking their scrap directly from suppliers to the furnaces."

Noskov disclosed that Russia lacks industrial plants to produce such small but necessary foundry equipment as gaggers and simple instruments. Foundry workers themselves make these items.

"The Krasnaya Presnya plant in Moscow is the only source of basic foundry equipment; but it doesn't make enough, and the quality of its machines do not always measure up to present-day requirements. Machine-building enterprises are compelled to make their own heavy foundry equipment.

"Under such conditions," Noskov declared, "it is difficult to mechanize foundry processes—much less make them automatic."

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'SAIRSET gives you one mortar for all types of service—industrial furnaces, boilers, ladles, flues and stacks, and rotary kilns. Its use is universal. It is recommended for laying high duty or super duty fire-clay brick, high alumina brick, or insulating firebrick. 'SAIRSET welds the brick into a one piece unit at temperatures too high for less refractory mortars—or at temperatures too low for heat-setting mortars to form a good ceramic bond.

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DOES NOT STIFFEN IN THE DRUM

The plastic consistency of 'SAIRSET makes it easy to remove from the drum. No time is lost and no mixing due to stiffening is necessary. Permits long storage and affords extra savings through the purchase of large quantities.

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'SAIRSET does not settle out of suspension in the mortar box. Constant agitation is unnecessary to maintain the proper consistency.

EASY TO USE

'SAIRSET comes on the job ready mixed to troweling consistency—with all of its plasticity and other properties fully developed to bring you maximum efficiency and make using easier.

PACKAGED IN READY MIXED PLASTIC FORM

No long soaking period is required to develop the plasticity and smooth workability of 'SAIRSET. Special equipment is used to thoroughly mix 'SAIRSET before it is packaged in airtight containers. Available in 200 and 500 pound metal drums and 5, 15, 50 and 100 pound metal pails.

Your local A. P. Green distributor carries 'SAIRSET and other refractory products in stock. You'll find him listed in the yellow pages of your telephone directory, or write

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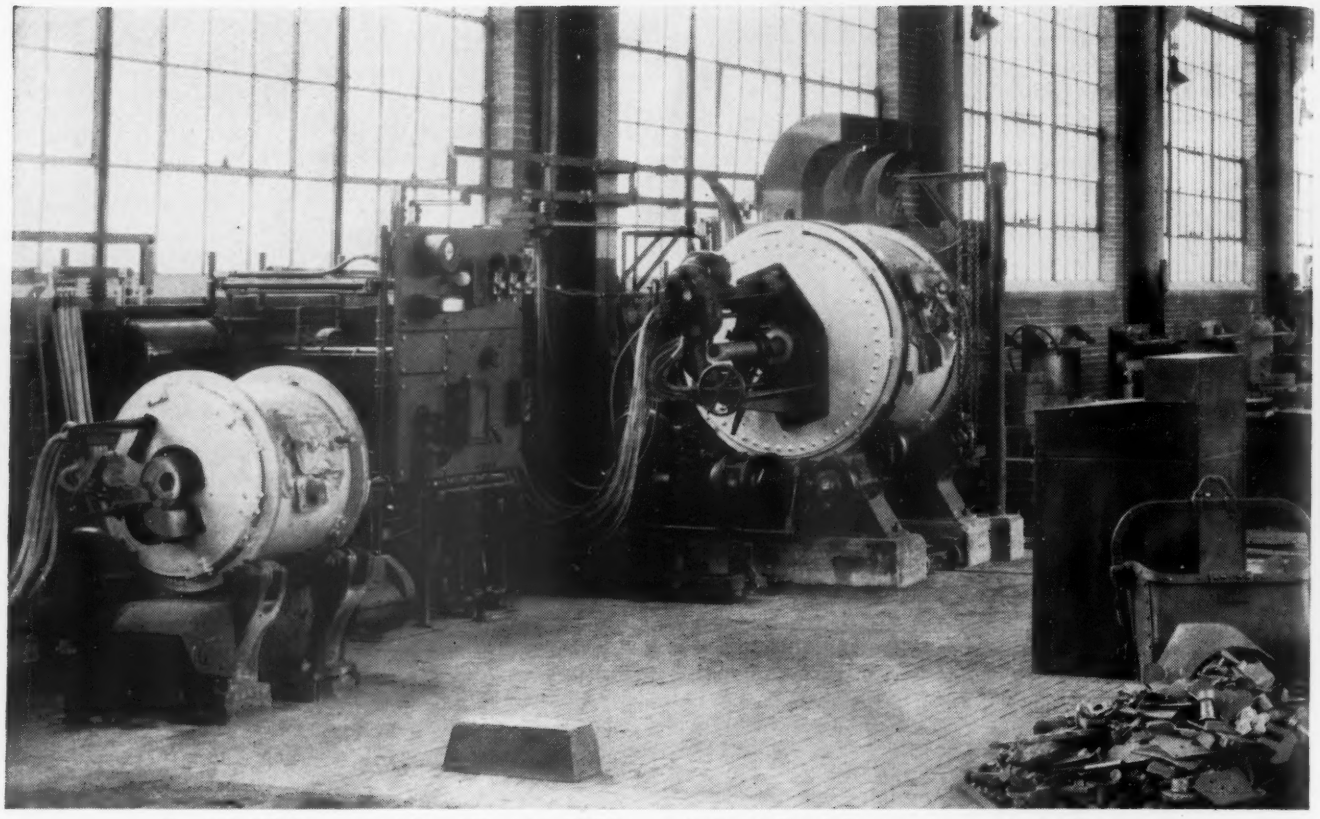
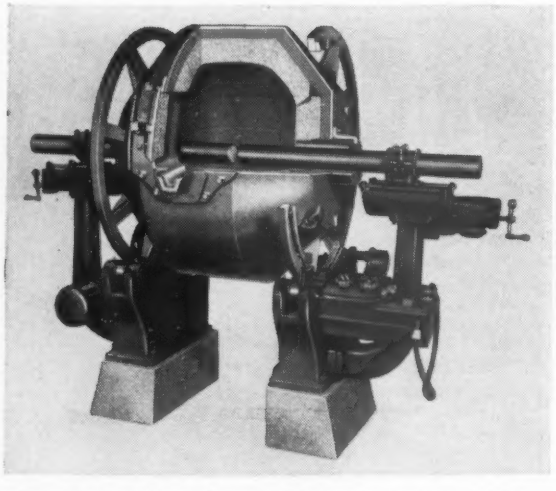


Type LFA, 350 lb. capacity, left, and Type AA, 1000 lb. capacity Detroit Electric Furnaces. In operation for 25 years.

Two of the reasons why we can't depend on *replacement* sales



Cutaway view shows features of Detroit Rocking Electric Furnaces.

The two Detroit Rocking Electric Furnaces shown above are 25 years old. They've been producing high quality metal at Baker Perkins, Saginaw, all that time—and they're still in top shape.

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Lasting economies are part of the picture, too: Optimum use of power, minimum heat loss, less metal shrinkage, more heats per shift, less down-time because of longer refractory service and easy shell replacement.

Detroit Rocking Electric Furnaces are available in capacities from 10 to 8000 pounds. They're individually designed to fit your plant's electrical specifications.

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SFSA T & O Committee: Rear, left to right, H. E. Gebhardt, Continental Foundry & Machine Co.; F. B. Barclay Jr. and A. T. Bird, General Steel Castings Corp.; W. J. Stewart, Dominion Foundries & Steel Ltd.; A. H. Herrmann, Racine Steel Castings Co., Racine, Wis. Left to right in front, Robert Bedford, American Cast Iron Pipe Co.; R. C. Wood, Minneapolis Electric Steel Castings Co.; and E. B. Nutter, Alloy Steel & Metals Co.

STEEL FOUNDERS' SOCIETY

Holds Tenth T & O Conference

TENTH anniversary Technical and Operating Conference of the Steel Founders' Society of America was held at the Carter Hotel, Cleveland, Nov. 16-18. Attendance totaled 561 men from the industry and guests.

Robert C. Wood, national chairman of the T and O Committee and president of the Minneapolis Electric Steel Castings Co., keynoted the conference with the statement that "the advanced steel casting technology being presented at this meeting did not exist ten years ago and thus represents the degree of progress which has been made in the industry."

Mr. Wood paid tribute to the hundreds of men who have served on the committees or participated in conference programs and paid special tribute to the technical leadership of Charles W. Briggs, technical and research director of the society. Mr. Wood went on to say that the cooperation and enthusiasm of the industry, coupled with this leadership, was responsible for the advance of the past ten years.

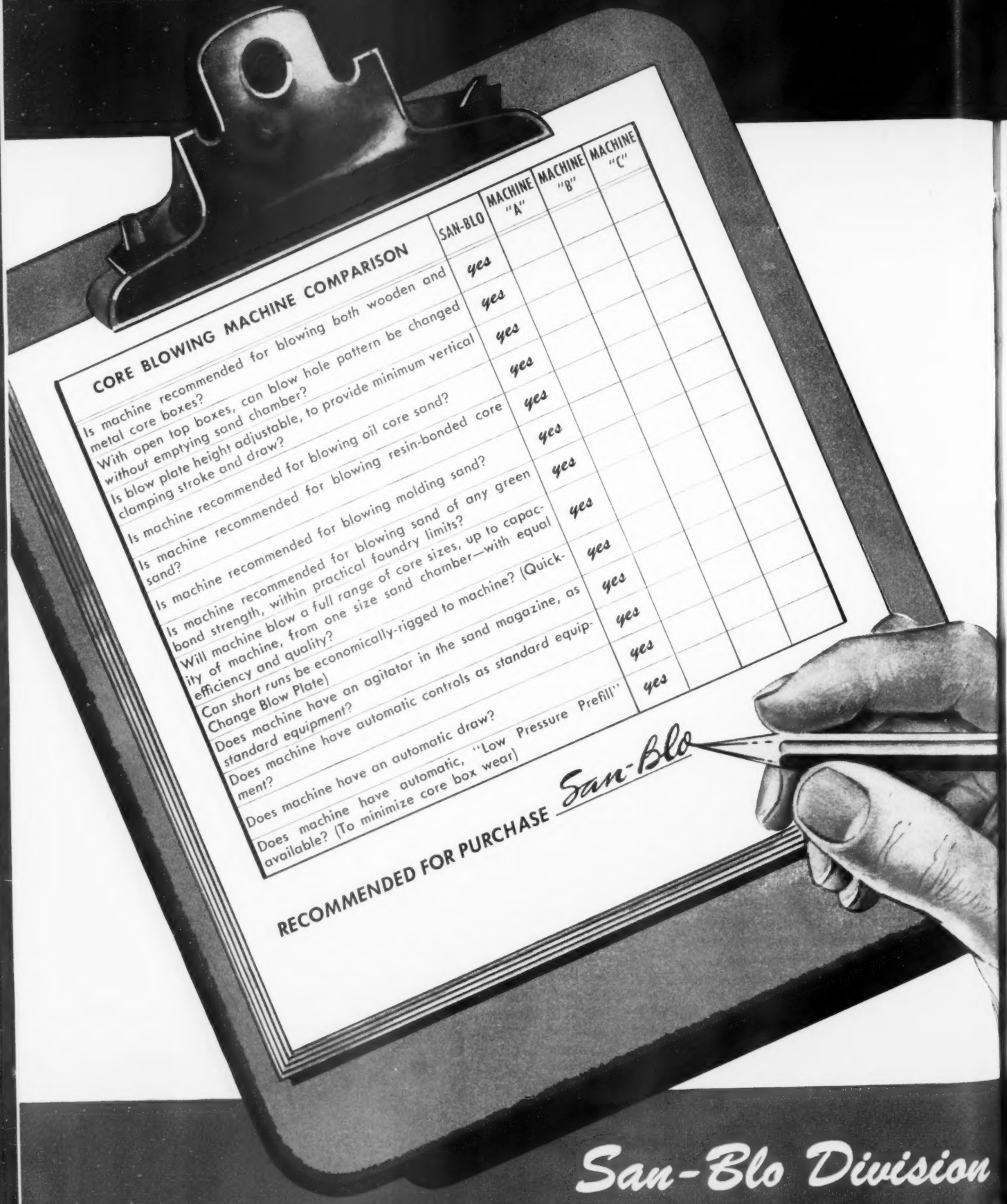
Lee C. Wilson, honorary member of the Steel Founders' Society, was honored at the Nov. 16 luncheon meeting as the Technical and Operating Committee chairman. In his remarks he called attention to the visions and hopes which the early committees held for the conference and which have been achieved and excelled in recent years. A. J. McDonald, president of the SFSA and vice president of American Steel Foundries, Washington, reviewed some of the society activities in his luncheon remarks.

The first session was devoted to molding developments and covered centrifugal, "D" process, shell, cold setting and CO_2 binders and a discussion of diaphragm molding equipment. Cold setting binders are being used for cores up to 700 lb, and discussion revealed that some foundries are using the CO_2 process for as much as 25 per cent of their core requirements. Use of data obtained from SFSA research projects in shell molding has led to considerable improvement in this field in production of low-carbon steel castings.

The session was continued into the afternoon, with patternmaking being added to the discussion. Increased

In the spotlight at the 10th annual SFSA T & O Conference were, left to right, standing, R. C. Wood, present chairman of the T & O Committee, and Charles W. Briggs, SFSA technical and research director since 1938, and, seated, Lee C. Wilson, honorary society member, who was its first T & O chairman

MORE VALUE FOR YOUR MONEY W


CORE BLOWING MACHINE COMPARISON
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MACHINE "A"
MACHINE "B"
MACHINE "C"
Is machine recommended for blowing both wooden and metal core boxes? yes
With open top boxes, can blow hole pattern be changed without emptying sand chamber? yes
Is blow plate height adjustable, to provide minimum vertical clamping stroke and draw? yes
Is machine recommended for blowing oil core sand? yes
Is machine recommended for blowing resin-bonded core sand? yes
Is machine recommended for blowing molding sand? yes
Is machine recommended for blowing sand of any green bond strength, within practical foundry limits? yes
Will machine blow a full range of core sizes, up to capacity of machine, from one size sand chamber—with equal efficiency and quality? yes
Can short runs be economically-rigged to machine? (Quick-Change Blow Plate) yes
Does machine have an agitator in the sand magazine, as standard equipment? yes
Does machine have automatic controls as standard equipment? yes
Does machine have an automatic draw? yes
Does machine have automatic, "Low Pressure Prefill" available? (To minimize core box wear) yes
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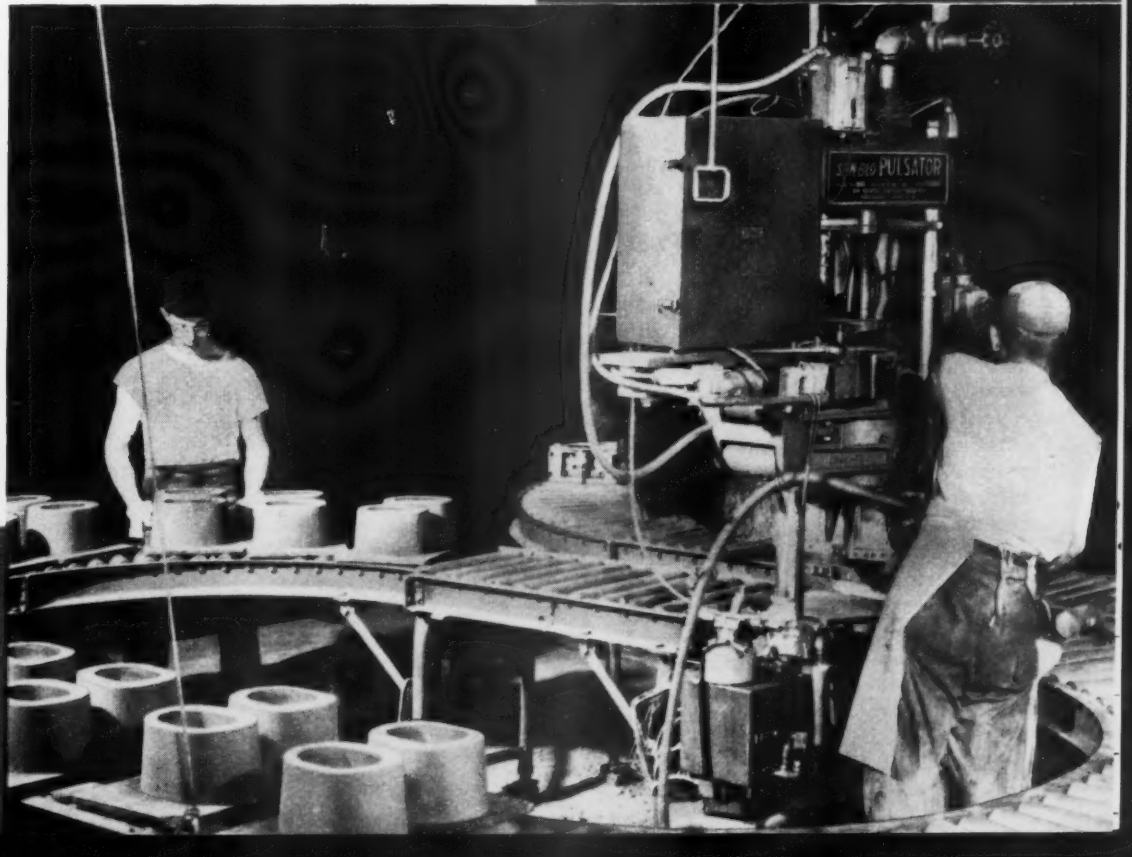
Y WITH SAN-BLO

When it comes to deciding *which* core blower to buy—you've got to look *beyond* the investment involved. You should check closely into the *advantages* and *versatility* offered by the machines you're considering and compare essentials provided as *standard equipment.*

Then, and only then, can you get a true line on *what you're going to get* for your core blowing dollars. The comparison chart on the opposite page should be very helpful to you in arriving at a decision. Answers to important core blowing questions are filled in for the SAN-BLO and space provided for other machines you may be considering. *This honest evaluation of machine merit will lead to your purchase of the* SAN-BLO!

Additional information on the SAN-BLO, for further comparison, is available on request. Or, let us know if one of our field engineers can be of assistance. Write to the SAN-BLO Division, The Federal Foundry Supply Company, 4600 East 71st Street, Cleveland 5, Ohio.

A model "250" SAN-BLO in a production foundry, blowing cores weighing up to 250 lbs. each.



A model "40" SAN-BLO in a steel foundry, blowing runner cup cores.

FOUNDRY EQUIPMENT MEMBER FEMA MANUFACTURERS ASSOCIATION INC.

use of plastics in patternmaking was identified with discussion as to the problems involved in handling and storage. Some new aspects of pH control of foundry sands indicated that this subject will be given thorough attention by the SFSA in the future. This session also included considerable stress on metal-mold interface problems. Favorable production results with molding refractories as outlined in a society research project were reported.

Inspection methods featured the Thursday program. Safety precautions in the use of radioactive cobalt in strengths of around 10 curies were stressed in the discussion. The pressure testing of steel cast valves on a production line basis revealed some interesting techniques designed to insure proper functioning at the higher pressures and temperatures to which these valves are being submitted in current designs and layouts.

Dye penetrants shared in the discussion and considerable attention was paid to magnetic particle inspection. It was revealed that several new techniques and fixtures have been developed all tending to put this method on a production line type of operation. The use of high amperage Magnaflux to reveal subsurface defects also was presented. The danger of false indications at these amperages was emphasized. It was shown that the interpretation of high-amperage results is in its infancy and requires more study before it can be used successfully.

Discuss Welding Developments

The use of new welding developments characterized the afternoon session. Among these were the tungsten inert arc for special applications in high alloy. The procedure described makes it possible to weld some of these alloys, which heretofore were outside of the practical range, and further, that the electrodes for such purpose were cast from the same heat as the alloy itself. Further attention was given the shielded inert gas arc welding process and the filler arc using CO_2 gas. Development of high deposition rates with the submerged arc in cast and composite-weld fabrications have further reduced the cost of these processes.

Melting and heat treating came in for practical discussion on Friday morning and was followed by a discussion of recent research reports. A "True or False" quiz on the last ten reports found Division III with the best score among those present at the meeting.

A panel quiz on core and molding sands resulted in Division I being awarded the trophy by the judges.

MALLEABLE FOUNDERS' SOCIETY

Wins National Safety Council Safety Award

MALLEABLE Founders' Society, Cleveland, was presented the National Safety Council award for association safety activity during the National Safety Congress in Chicago Oct. 17-21. Carl L. Liebau, president of the society and president, Federal Malleable Co., West Allis, Wis., received a plaque from David L. Arm, manager of the council's industrial department, on Oct. 19. Mr. Liebau is on the right in the illustration above.

The Malleable Founders' Society was recognized for its outstanding reduction in injury frequency rates and for general excellence of its safety program for the industry. Frequency rates were reduced 50 per cent during the last 5 years and 28 per cent during 1954. The safety program includes special contests and awards for companies in several size groups; publication of safety bulletins containing helpful suggestions on safety promotion and the elimination of causes of accidents; and publication of injury frequency rates, including analyses for comparative purposes.

The society's services effectively supplement those of insurance companies, local safety councils and the National Safety Council, particularly for smaller companies which need more outside help. The society has found that it is in an advantageous position to help the industry do more to solve its own accident problems.

At the Safety Congress, the society was one of several associations which provided educational exhibits of safety publications and services. Its display is illustrated below.

. . . and, equally important, guidance along the course

That's what the American Foundrymen's Society has brought to the castings industry over the past 60 years

. . . the *power* that comes with sound technical knowledge

. . . the channeling of that *power* in the right direction

Progress requires that every faction, in all divisions, must constantly be familiar with new products and new processes to enable the entire field to maintain a competitive industrial position. Actually, the castings industry, like all other basic sources of mass-production manufacture, can advance only in direct proportion to the advancement of individuals within the field . . . in all of the various related phases of operation, from raw material to delivery of finished products.

Reliable technical knowledge must be augmented by contacts within the industry, for both companies and individuals. Consequently, the membership of the American Foundrymen's Society directly shares in the far-reaching benefits derived from: Committee Activities . . . National Conventions . . . Foundry Shows . . . Educational Activities . . . Safety, Hygiene and Air-Pollution Control Programs . . . Research Projects . . . Chapter Contacts . . . Regional Conferences . . . Technical Publications . . . "Modern Castings."

AFS membership is the blending of men, materials and methods within the castings field . . . bound together cooperatively in the common cause of Progress. Every company, every individual, is better equipped to meet the challenge of today's competition with the help that stems from membership in the American Foundrymen's Society.

American Foundrymen's Society

Golf and Wolf Roads, Des Plaines, Illinois

AFS

It will help those, who are not now AFS members, to act now! Fill in and mail this coupon — full details on all Classes of Membership will be forwarded without delay.

I am interested in knowing more about the advantages of Membership in the American Foundrymen's Society. Send full details to:

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Around the Country

NEWS REPORTS FROM

Chicago . . . New York . . . Pittsburgh . . . Los Angeles . . . Philadelphia

Pittsburgh—United Engineering & Foundry Co. has made another offer to the government to buy the foundry it owns in New Castle, Pa. Talks are continuing between government and company officials respective to a possible purchase.

Transfer of ownership of Continental Foundry & Machine Co. business, physical assets and inventories to Blaw-Knox Co., Pittsburgh, took place Nov. 14. Continental properties for manufacture of foundry products and mill equipment will be operated as the Continental Foundry & Machine Division of Blaw-Knox Co.

Foundries supplying the steel industry with equipment are enjoying strong sales, and railroads have also increased their purchasing here. Steel industry suppliers will have completed one of their busiest years at the end of 1955. H. Russell Loxterman, sales manager, steel plant equipment department, Blaw-Knox, says shipments so far reported indicate 1955 is the best year for that department since the heavy steel expansion of 1951.

New York—An active market for both ferrous and nonferrous castings is expected in January. During the Christmas week various foundries closed down for inventory-taking and general observance of the holidays, but gray iron operators expect to be running soon at 85 to 90 per cent of normal and the nonferrous operators at least at 90 per cent, if not better. Aluminum casting makers, in fact, expect operations up in the 90's.

Most gray iron shops will again be operating close to five days a week and in some cases more. Backlogs average six to seven weeks, reflecting a diversity of orders. Malleable shops report even more extended backlogs, with no little of this business involving building hardware.

Building requirements for brass and bronze will continue heavy. Meter manufacturers have more than they can handle and are expected to continue to farm out work. Demand for valves and spigots is brisk. Railroad shops are buying bronze castings more actively. Shipyards are requiring more castings for Navy work as well as commercial business. Aluminum shops are busy with aircraft and radar work, oil burner frames, washing machine components and other requirements.

Red metal scrap has been hard to get, with prices advancing. This situation is expected to ease with the turn of the year. Ferrous scrap prices also have been strong. But here, too, some leveling off is expected.

Chicago—Foundrymen and pig iron sellers alike are becoming concerned over the iron supply during early 1956. With orders for gray and malleable iron castings mounting rapidly, foundries have been melting more metal and have found it advantageous to carry bigger iron inventories. Some pig iron distributors report their November shipments were the biggest in history and December has been keeping pace.

A group of 11 gray iron shops, including both jobbing and captive, in the Chicago area in late November reported on business activity. Operating rates ranged from 78 to 105 per cent of capacity. Average for the group was 91 per cent. Operating hours per week ran from 40 hours in several shops to 48 hours in at least three others. Most agreed business outlook for the next three months is good or very good.

A factor in the swelling demand for pig iron is the sharply rising price and growing shortage of good quality scrap. Foundrymen find it economical to increase the ratio of pig in their melts.

A similar situation occurs in steelmaking. High-priced scrap encourages mills to use more blast furnace hot metal in open-hearth heats. Thus the demand for merchant iron couples with heavier use of hot metal to tax output of blast furnaces. And at start of the new year there is no indication either factor will lessen; rather the reverse appears likely.

Of the Chicago district 43 blast furnaces, only 40 were operating in early December. All three idle stacks are steelworks units down for relining and major repairs. These will be relighted soon, but other units must go out for repairs. Consequently, as demand for foundry and malleable pig iron increase, there is small likelihood production will expand.

Los Angeles—Optimistic foundrymen are freely predicting an active first quarter that may see some shops push quarterly sales volume as much as 10 per cent beyond the like period of 1955. But why early year business should be so good is hard to explain. Every foundryman has a different answer, and some of them have no answer at all. Customers' inventories are working down almost at a record rate.

One explanation for the good business is the resurgence of aircraft, Los Angeles' leading manufacturing industry. The Defense Department's dispersal policy frightened some aircraft companies into purchasing only for immediate requirements. Recent statements by Secretary Quarles have allayed these fears, with the result that West Coast plants are ordering more castings. While light metal foundries benefit most from this increase, the optimism in aircraft circles has had a healthy effect on the industrial scene in general.

The dispersal policy did have one beneficial result. It sent foundries scurrying after commercial business to offset the possible loss of aircraft and other defense accounts. This has led to new business from additional sources which have greatly augmented defense orders.

Of interest to foundrymen is an attempt by some members of the City Council to raise the 13-story building lid which has kept Los Angeles a horizontal city. If successful, the effort could mean an influx of new industry in the area. Some of the nation's largest companies have stayed out of Los Angeles because of the height limitation on buildings.

Philadelphia—An early rebound from the holiday season is looked for by gray iron founders here. They expect operations to resume soon at five days a week, plus overtime. At

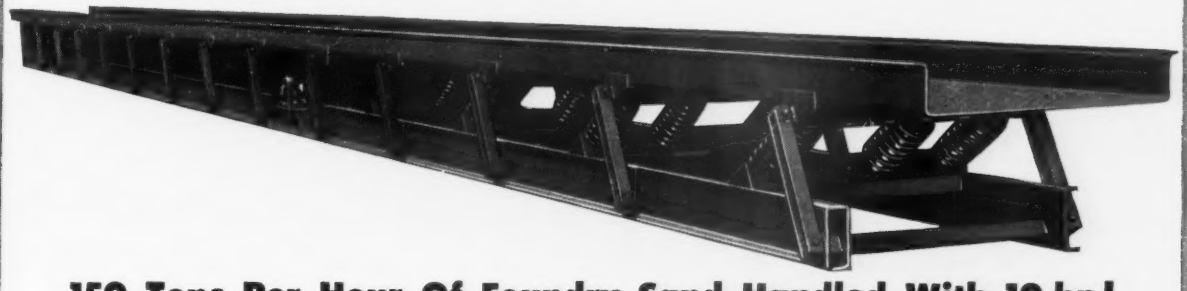
RUGGED?

10 hp CARRIER CONVEYOR Moves 84,000 Foot-Tons Per Day!

THERE'S almost no limit to how rugged a Carrier Natural-Frequency Conveyor can get. Nor to what "impossible" jobs it can do. That's because Carrier Conveyors operate according to the laws of Natural Frequency and the application of this scientific principle was pioneered exclusively by Carrier.

NATURAL FREQUENCY: Carrier Natural-Frequency Conveyors substitute the natural resonant action of springs for brute force — thus UTILIZING the tremendous force of periodic vibration which, before Carrier, was considered a liability. Most of the power needed to operate Carrier Natural-Frequency Conveyors is repeatedly stored up in the springs, and returned on every stroke. The result — *much less power required . . . far less maintenance . . . far less down-time!*

Carrier Natural-Frequency Conveyors are now delivering incomparably efficient, trouble-free performance for many of America's biggest industrials. Mail the coupon, *today*, for all the facts.



150 Tons Per Hour Of Foundry Sand Handled With 10 hp!

Handling up to 150 tons per hour of foundry sand — including occasional sprues and tramp iron — is a rough, tough job. But it's a *cinch* for this 70-foot Carrier Natural-Frequency Conveyor! This big Heavy-Duty unit has a ⅜" steel-plate pan, 36" wide, and is powered by one 10 hp drive. Vibrated weight is approximately three tons. More than 50 giant coil springs are used. Full details gladly sent on request.

CARRIER ADVANTAGES

HIGH CONVEYING SPEED
(Up to 100 feet per minute)

GREATER CAPACITY
(Up to 200 tons per hour)

LESS POWER REQUIRED
(About one-third as much as "competitive" equipment)

LESS MAINTENANCE & DOWN-TIME
(Less power + good design = trouble-free performance)

NO DAMPENING UNDER LOAD
(Designed with extra power for specified load, with positive stroke)

SELF-CLEANING
(Continuous, smooth trough — no pockets)

COMBINES PROCESSING WITH CONVEYING
(Can screen, dry, cool, dewater, blend, etc.)

WIDTHS FROM 6" TO 48"—LENGTHS FROM 5' TO 250'
(With pans 16 ga to ½" plate, of any metal, open or enclosed)

BALANCED, VIBRATION-FREE UNITS AVAILABLE
(For use on ceilings or light floor construction)

CARRIER NATURAL-FREQUENCY CONVEYORS

Carrier Conveyor Corporation
2142 Frankfort Avenue, Louisville 6, Kentucky

Gentlemen: Without obligation, please send me Carrier Natural-Frequency Conveyor Bulletin No. 111.

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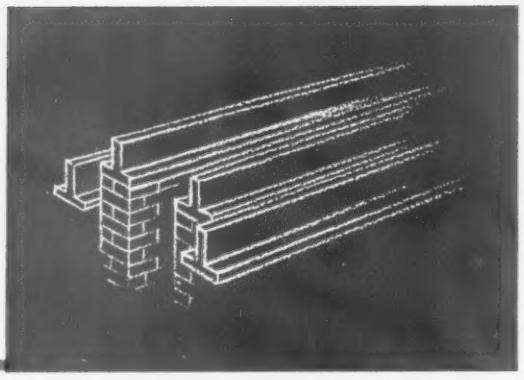
Att. Mr._____ Dept._____

HOLCROFT and the WALKING BEAM FURNACE



Step up production of l-o-n-g parts

The walking beam furnace is an automatic, high production furnace usually used for treating bar stock, tubes, axles, and similarly shaped products.

Stock handling is ingenious. Two sets of rails—one stationary—run the length of the furnace. The moving set lifts the stock, travels forward, and then drops down below the level of the stationary rails. The rails return to their original position and repeat the action, walking the work through the furnace. An alternate arrangement includes two sets of moving rails. One pair lifts the stock as the second moves backward. The first comes down, deposits the work on the second, which moves forward conveying the work through the furnace cycle.

Yes, there's more to designing a heat treat furnace than a knowledge of metallurgy. Other factors—stock handling for one—must be considered, too. That's why it's a good bet to bank on Holcroft experience. It will pay off in the long run.

Write for your copy of Blazing the Heat Treat Trail.

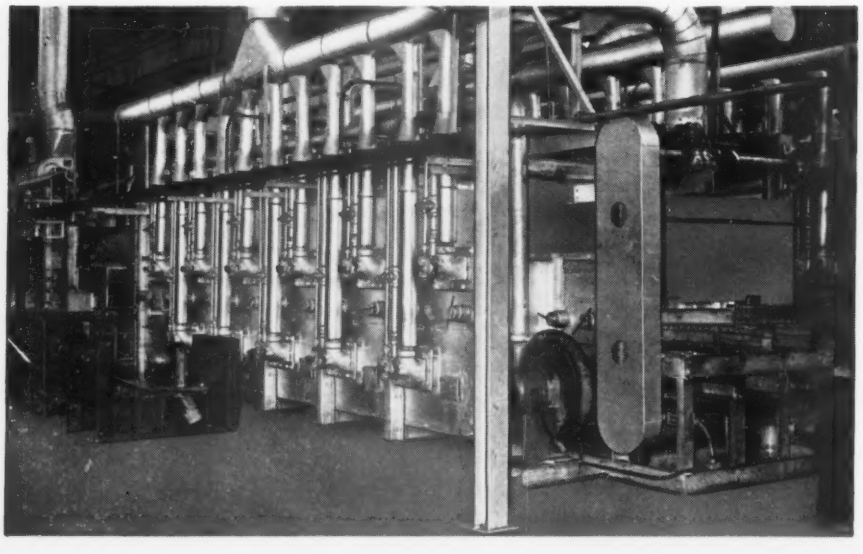
HOLCROFT AND COMPANY

BUILT BY HOLCROFT & COMPANY DETROIT, MICH.

6545 EPWORTH BOULEVARD • DETROIT 10, MICHIGAN

PRODUCTION HEAT TREAT FURNACES FOR EVERY PURPOSE

CHICAGO, ILL. • CLEVELAND, OHIO • DARIEN, CONN. • HOUSTON, TEXAS • LOS ANGELES, CALIF. • PHILADELPHIA, PA.
CANADA: Walker Metal Products, Ltd., Windsor, Ontario



least, they say, this should apply to companies accounting for close to 85 per cent of melt in this district. Backlogs at jobbing shops now average approximately seven weeks.

Gray iron demand is well diversified, including requirements for power transmissions, bread-making machinery, textile equipment, etc. Electrical equipment, material handling machinery and pumps and valves also are requiring substantial tonnage. One consumer in this district is requiring 275 tons a week for auto dies. A pipe shop has had an overflow of hydrant work and has been trying to sublet some of it.

Steel casting makers are fairly active, although not as busy as they would like to be. Most are operating at around five days a week, with little or no overtime, and have backlogs on this basis of around six weeks. Malleable shops are very busy on pipe fittings, hardware, some railroad work and miscellaneous demands. Automotive requirements for malleable are not very heavy in this district. Brass and bronze shops are busy but do not appear to have much backlog. Light metal foundries are averaging around six days a week, with backlogs well extended, particularly where aircraft and radar work is involved.

Ferrous scrap is becoming increasingly scarce, as reflected by high prices. Foundry iron is still readily available but supply is tightening, as has been the case for some time in basic and malleable.

Transportation Field Is Chief User of Aluminum Castings

A statistical breakdown by the Aluminum Association of end-use shipments indicates that nearly 70 per cent of permanent mold castings and 31 per cent of sand castings of aluminum shipped during the first half of 1955 went into transportation (motor vehicles).

Direct sales to military agencies and orders for the Atomic Energy Commission constituted 21.7 per cent of sand castings shipped and 4.9 per cent of permanent mold castings. Complete tabulations are listed below. No figures for aluminum die castings were released.

Per Cent of Total Shipments, Jan.-June, 1955

Class	Permanent Mold Castings	Sand Castings
Mining, construction and agriculture machinery—implements..	3.0	1.4
Transportation — motor vehicles (except military)	69.7	30.9
Transportation — miscellaneous (except military)	4.0	9.8
Industrial and commercial machines, equipment and tools ..	5.3	25.6
Communications equipment and		

take a number from 1 to 10

Take any number from the check-list below, and you'll find an advantage offered by Penolyn Core Oil. It meets the most exacting foundry requirements, helps you make castings with maximum efficiency. But most important—

If you require expert technical assistance or technical data regarding your present or future casting operations, just call the Penola Office nearest you.

Penola

specify PENOLYN CORE OIL

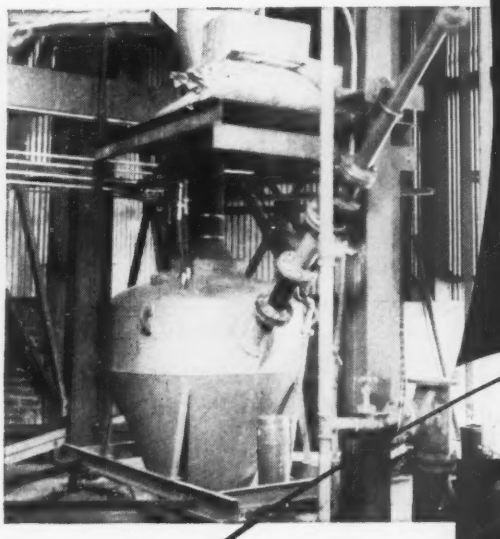
for these 10 important casting advantages:

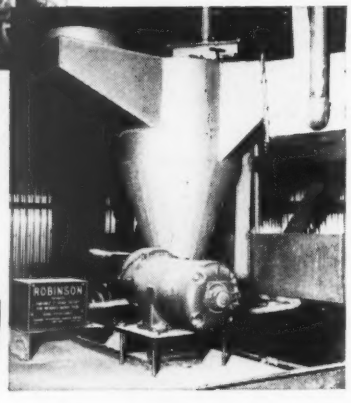
1. Dependable uniformity
2. Concentrated form
3. No obnoxious odor
4. Seepage eliminated
5. No crusting, green mix
6. Always clean working
7. Wide temperature range
8. Polymerized formulation
9. Minimum gas
10. Ample collapsibility

PENOLA OIL COMPANY • NEW YORK • CHICAGO • DETROIT

Robinson Air-Activated Conveyor System

One Highlight of this LYNCHBURG FOUNDRY Installation





Remarkably Accurate Batches of Sand Automatically Weighed and Transported

By "remarkable accuracy" we mean within 1 to 3 pounds in 1,000 . . . an accuracy made possible by the System's use of the Baldwin Electronic Load Cell weighing unit, which can be set for any demand batch in weights up to 2500 pounds.

Actually, there are two Robinson Systems at Lynchburg. One, with the Activator Unit located under the hopper-car unloading station, conveys Pennsylvania Glass Sand (120 AFS) to the storage bins. The second unit weighs and loads sand automatically from these bins on demand and transports the weighed batch to the muller line. It takes about 1 minute to weigh and transport one batch. Air consumption is less than ⅓ cubic foot of free air per pound of sand conveyed.

Why not send us an outline of your proposed or existing sand and binder handling requirements and let's see what the Robinson System can offer? If you purchase a Robinson System, you will be doing what Ford-Dearborn, Ford of Canada, U.S. Steel (Edgar Thompson Works) and others have done to their advantage.

ROBINSON Air-Activated CONVEYOR SYSTEMS

A Division of Morse Boulger Destructor Co.

80-W FIFTH AVENUE • NEW YORK 11, N. Y.

Representatives in Principal Cities

electronic devices	0.2	1.4
Office equipment and machines	0.5	1.0
Plumbing, heating and builders hardware	0.5	1.5
Photographic and optical, scientific, measuring, recording, medical and control laboratory instruments and equipment	0.6	3.3
Timing devices, clocks and time operated equipment, vending machines	..	0.2
Home appliances, furnishings, equipment	11.2	1.2
Sporting goods, jewelry, personal goods, toys	0.1	..
National defense	4.9	21.8
Unidentified	..	1.9
TOTAL	100%	100%

FOUNDRY Index Ready Soon

Index to FOUNDRY, Volume 83, listing by title, subject matter and author the editorial material published during 1955, will be ready soon.

Readers find the index a ready reference to various phases of foundry practice, new techniques and recent developments in the industry and a quick means of locating information published during the year.

Subscribers may obtain copies without charge by directing requests to FOUNDRY, Penton Building, Cleveland 13, O.

Book Review

Metals Handbook, 1955 supplement, 208 pages, published by the American Society for Metals, 7301 Euclid Ave., Cleveland 3. Price: $6.

This supplement to the ASM *Metals Handbook* follows the general plan used in the 1954 edition. The 21 articles it contains were written by 19 technical committees of the societies and are divided among four main sections: Metals and Applications, Design and Application, Processing and Fabrication, Testing and Inspection.

Of particular interest to foundrymen should be material presented under the following titles: "Selection of Aluminum Alloy Castings;" "Selection of Gray Cast Iron;" "Induction Hardening and Tempering;" "Surface Finish;" "Metal Cleaning Costs," and "Radiography of Metals."

To make the information contained in the book readily available, an eight page index contains more than 2500 entries. Pinpointing specific data are 411 illustrations, 256 charts and 214 tabulations.

DUST and FUME topics

WHEELABRATOR CORPORATION Mishawaka, Indiana

Complete Control of Cast Iron Grinding Wheel Dust with Wheelabrator® Dustube Collector

Mass production grinding creates tremendous quantities of dust but it is efficiently kept under control at American Foundry Co. This Indianapolis foundry ventilates three swing grinders (illustrated above) that handle 170 automotive cylinder blocks hourly.

Grinding of gray iron, with its high quantity of free graphite, produces very small dust particles. These, if uncontrolled, can float around over considerable distances before settling. American Foundry Co's system of controlling this dust consists of local exhaust ventilation. Each swing grinder has a hood designed to pass air at high velocity to overcome (1) the room air currents and (2) the force imparted to the particles by the grinding wheels. The dust, thus corralled, is carried through a duct from each hood to a Wheelabrator Dustube Collector, where the air is filtered through cloth tubes.

COLLECTOR KEEPS PLANT FREE OF METALLIC DUST

Metallic dust from a disc grinder, 3 plate polishers, 2 double-stand snag grinders, and 4 double-stand grinders is trapped at its source by hooding in a Wheelabrator Dustube dust collection system at Detroit Michigan Stove Company. The dust collected weekly fills a 2-ton dump truck.

Eliminate Air Pollution From Electric Furnace Fume

Atmospheric pollution from electric steel melting furnaces need no longer be a problem. Wheelabrator Dustube Collector systems provide virtually complete removal of fume, discharging only clean gas. At Electrocast Steel Foundry Co. a Wheelabrator system keeps 1600 lbs. of dust and fume from the atmosphere every week.

Inside the foundry, the pouring floor is cleaner and working conditions more pleasant. Also, furnace roof life is 20% longer because it is kept clean allowing heat to dissipate properly.

Dust Control Aids Worker Efficiency Cuts Maintenance

Dust created in various manufacturing processes can be recovered with virtually 100% efficiency in a Wheelabrator Collector. In addition, efficiency of workers improves through better working conditions and maintenance costs are less because dust does not get into machinery.

Get the complete story on Wheelabrator Dustube dust and fume control. Write today for Catalog No. 372C.

WHEELABRATOR
CORPORATION
(Formerly American Wheelabrator & Equipment Corp.)
505 S. Byrkit Street, Mishawaka, Indiana

Industry BRIEFS

CENTRAL FOUNDRY CO., Newark, N. J., plans to spend $2 million for additional mechanization and expansion of its 105-acre plant at Holt, Ala. This will make a total of $7½ million spent for improvements since World War II. The company produces cast iron soil pipe and fittings. The new program includes the addition of continuous casting machinery for 2 and 3 inch pipe, plus further mechanization of manufacturing processes and material handling. Central Foundry now operates ten machines in the centrifugal casting of 3 to 8 inch soil pipe by the Nolan process, developed by J. J. Nolan Jr., president. Daily capacity is 12,000 to 15,000 standard 5-foot lengths.

Rockwell Mfg. Co., Barberton Div., Barberton, O., is modernizing its foundry to increase production of valves by 50 per cent. Automatic cupola charging equipment and larger capacity molding and pouring equipment are to be installed.

Lamson Mobilift Corp., Portland, Oreg., has appointed six dealers for its full line of lift trucks: Modern Handling Co. Inc., Indianapolis, to serve central Indiana; Dechert Machine Shop Inc., Palmyra, Pa., to serve the south central counties of Pennsylvania; Reagan Equipment Co., New Orleans and Natchez, Miss., selling in Louisiana and Mississippi; Bigelow Robinson Co., Little Rock, Ark., dealer for Arkansas and Oklahoma; Stanly Handling Equipment Co., Agawam, Mass., representative for Massachusetts; F. H. Ross & Co., Charlotte, N. C., to distribute through six branches in South Carolina, Georgia and northern Florida.

A & A Die Casting Co., 2029 Granville Ave., Los Angeles, has purchased a new one-story plant at 12901 South Western Ave., in Hollypark Industrial Center. Of concrete construction, the structure will cover 40,000 sq ft and will cost approximately $250,000. Victor O. Anderson and John H. Allen are co-owners of the firm.

Acme Aluminum Foundry Ltd. is a new aluminum foundry at 210 Salsbury Drive, Vancouver 6, British Columbia, Canada.

R. Hoe & Co., 150-year-old maker of printing presses, has established a contract manufacturing division. Since 1847 the firm has produced, on special assignment, more than $100 million worth of nonprinting equipment of many kinds. Its foundry at Dunellen, N. Y., can produce 60 tons per day of plain and alloyed gray iron castings in sizes up to 30,000 lb.

Oxford Industries Inc., 710 Erie County Bank Building, Buffalo, N. Y., a foundry, has been granted a charter of incorporation listing capital stock of 200 shares at no par value. Directors are Harry A. Rachlin, 108 Depew Ave.; Lauren D. Rachlin, 190 Sanders Rd.; and John T. Curtin, 1428 Amherst St., all of Buffalo.

Salem-Brosius Inc., Carnegie, Pa., has established a sales office at 15846 Monte Vista Ave., Detroit 38, to handle its mechanical equipment and materials handling equipment lines in the Michigan area. It will be directed by James D. Montgomery.

Texas Foundries Inc., Lufkin, Tex., recently poured the first castings at its new steel foundry. Since 1939, when the company first started operations, it has produced only malleable iron castings.

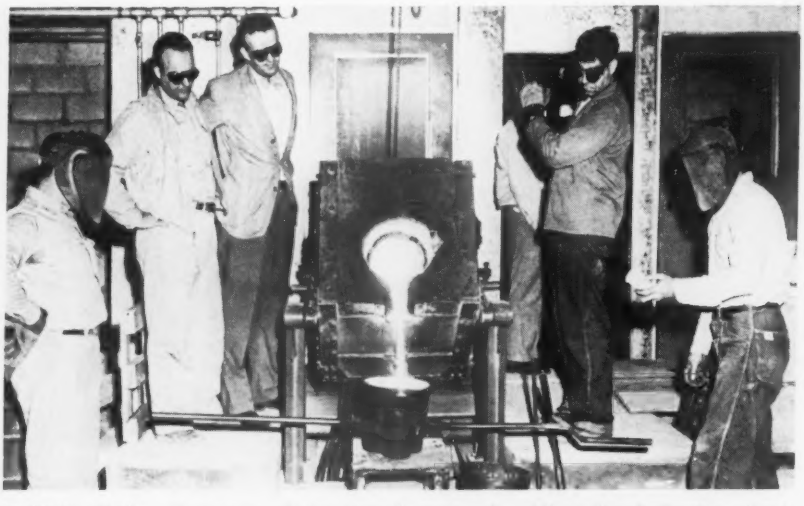
American Management Association has moved its administrative headquarters from 330 West 42nd St., New York, to the Sheraton Astor Hotel. The new address is 1515 Broadway, Times Square, New York.

Benbow Foundries Inc. has been formed in Wisconsin Rapids, Wis., with authorized capital stock of 1000 shares of common of no par value. David W. Benbor, 330 South Ninth St., Wisconsin Rapids, is the registered agent.

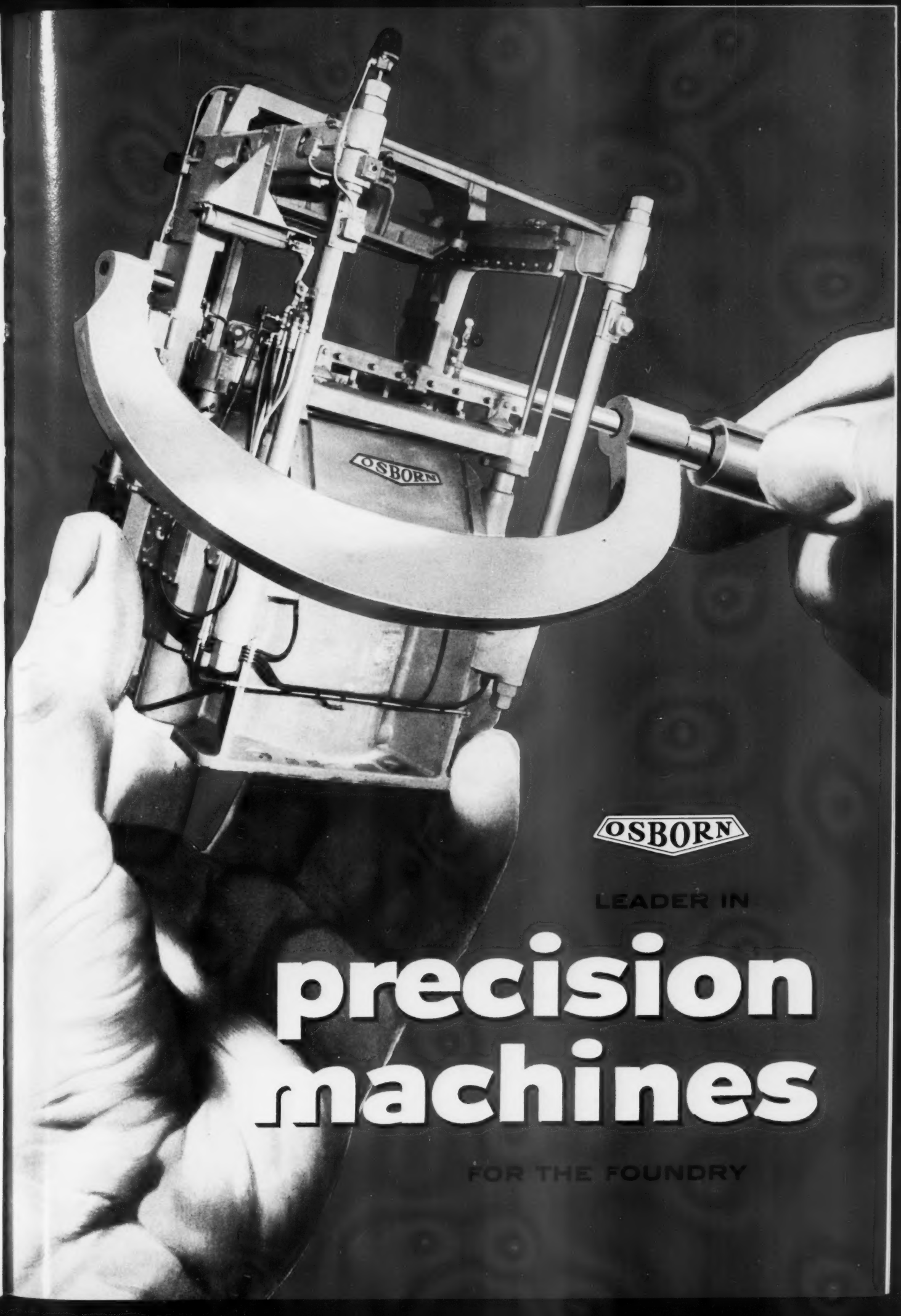
Russo Foundry Equipment Co., Oakland, Calif., has sold the manufacturing rights to its Monarch mechanical flask to the Newaygo Engineering Co., Newaygo, Mich. West coast sales will be serviced by the Russo organization.

Greenlee Foundries Inc., Chicago, has named William J. Willmot to be foundry manager and L. B. Harkrider to be sales manager following the recent retirement of Morris A. Scott.

A. Bertsch & Son Inc., 640 Pullman Ave., Rochester, N. Y. a foundry, has been granted a charter of incorpora-



INITIAL HEAT: Tapping of the first heat in the Alloy Steel Casting Co.'s new foundry, Southampton, Pa., is watched by Edward J. Querner, third left, vice president, manufacturing, Fischer & Porter Co., Hatboro, Pa., and Donald J. Volk, second left, president, Alloy Steel Casting Co., wholly owned subsidiary. The foundry expansion and modernization is part of the Fischer & Porter Co.'s new million dollar capital improvement program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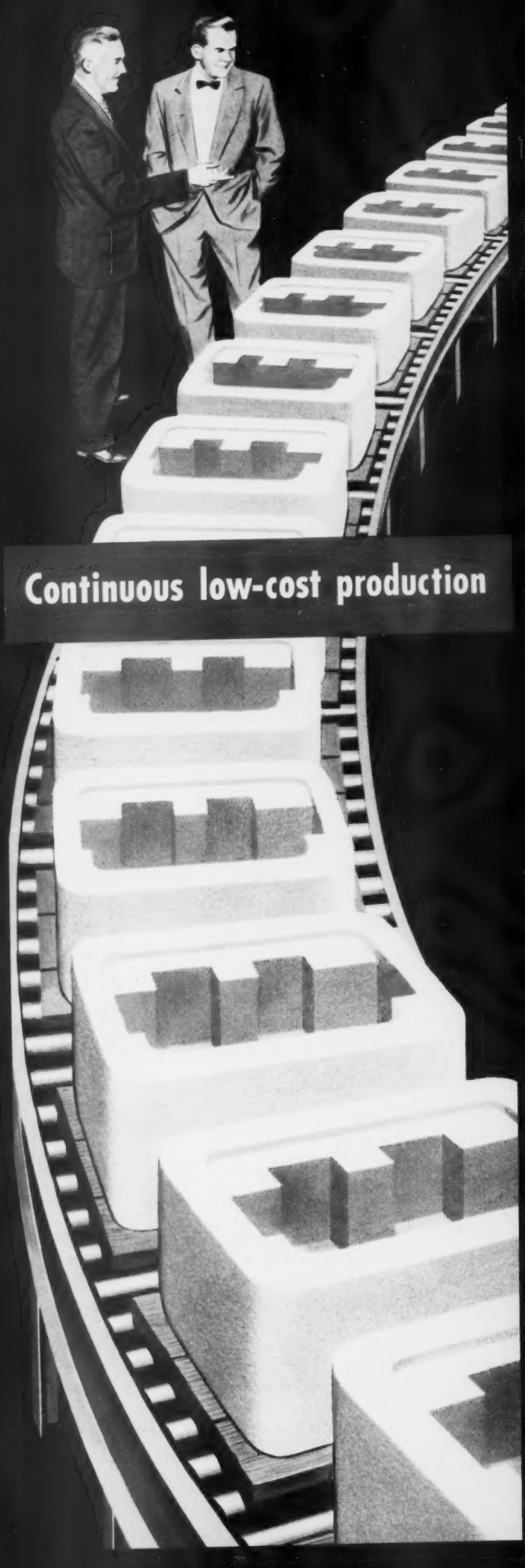
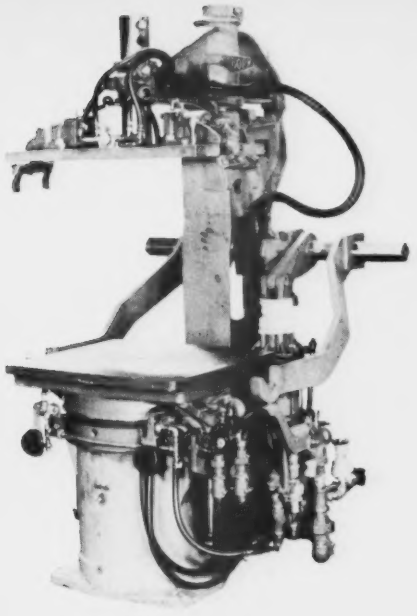

Continuous low-cost production



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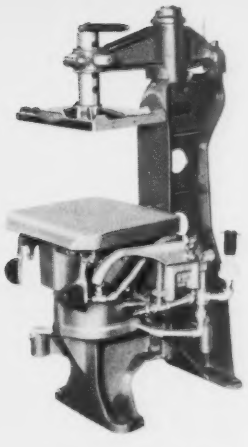

JOLT SQUEEZE

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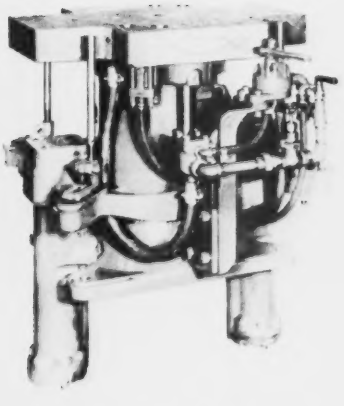

JOLT STRIPPER

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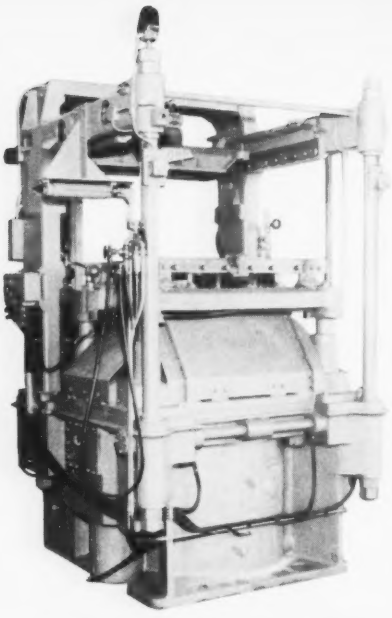

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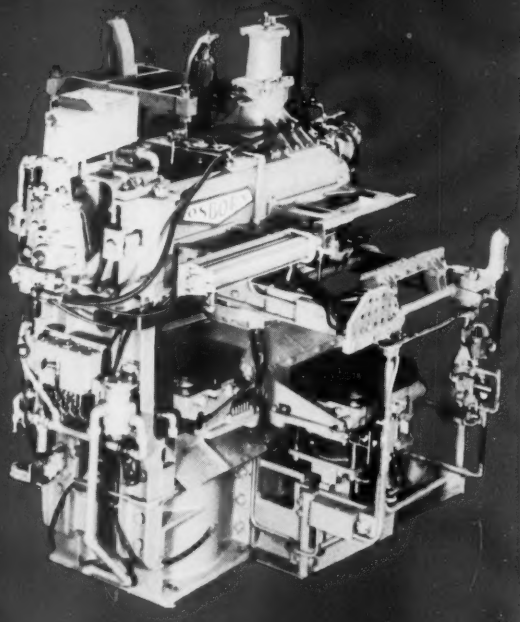

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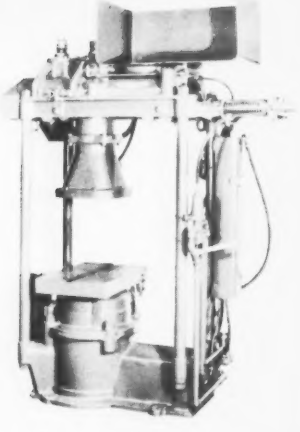
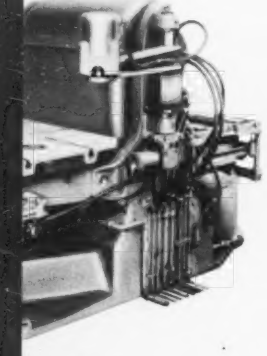
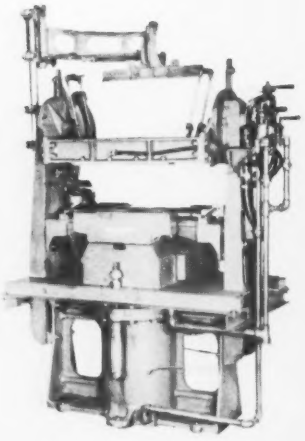


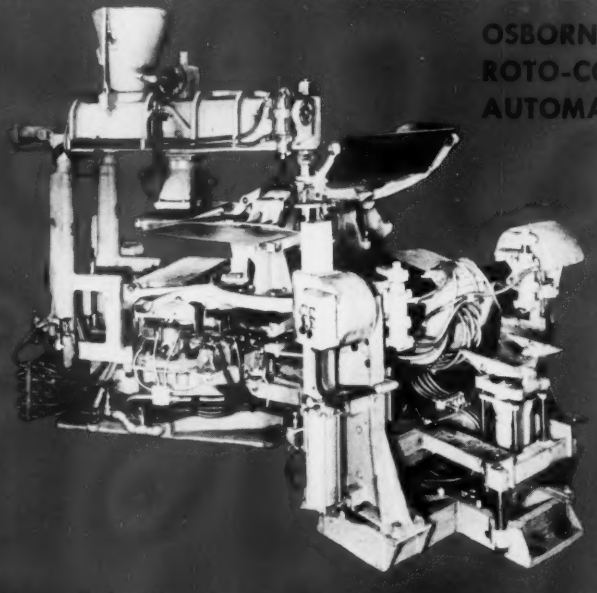
AUTOMATIC CORE BLOWER



ROCKOVER



JOLT ROLLOVER SQUEEZE



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Have an Osborn foundry specialist show how *you* may be able to simplify molding . . . mechanize or even automate costly hand operations. Write *The Osborn Manufacturing Company, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

Visit our Exhibit at the 1956 Castings Congress, Atlantic City, May 5-9.

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CORE BLOWERS MOLDING MACHINES
INDUSTRIAL BRUSHES

tion listing 200 shares of capital stock at no par value. Directors are Ira H. Morris, 261 Grosvenor Rd., Bruce R. Bertsch, 400 Sagamore Drive, and Richard C. Bertsch, 340 Mt. Airy Drive, all of whom are of Rochester.

Kaiser Aluminum & Chemical Corp. plans a $280 million expansion program that will bring the company's total primary aluminum capacity up to 654,000 tons per year. Major projects will be a 220,000-ton aluminum reduction plant at Ravenswood, W. Va and a 500,000-ton alumina plant on the Mississippi river near Gramercy, La.

Wheelco Instruments Division, Barber-Colman Co., Rockford, Ill., has appointed Grant Edgel Co., 8714 Northeast Siskiyou St., Portland 20, Oreg., to be its exclusive representative in the Portland area. The Seattle area now is being served by the division's branch office at 9590 Northeast 24th St., Bellevue, Wash. Ray E. Brainard is in charge.

Industrial Truck Division, Clark Equipment Co., Battle Creek, Mich., has appointed Industrial Lift Truck Co., 2900 East Tioga St., Philadelphia, to sell and service its line of fork lift trucks, powered hand trucks and straddle carriers.

Est Co., Grafton, Wis., producer of aluminum and magnesium permanent mold castings, has added a 50 x 100-ft steel and block section to its plant, which now totals 25,000 sq ft. This addition is the fourth the firm has made.

Walworth Co., New York, has acquired Conoflow Corp., Philadelphia, manufacturer of pneumatic automatic valve control equipment. It will be operated as an independent subsidiary.

Penn Instrument Co., Philadelphia, has appointed Bogart-Bullock Co., 6010 South Normandie Ave., Los Angeles 44, to be its exclusive industrial sales representative in southern California.

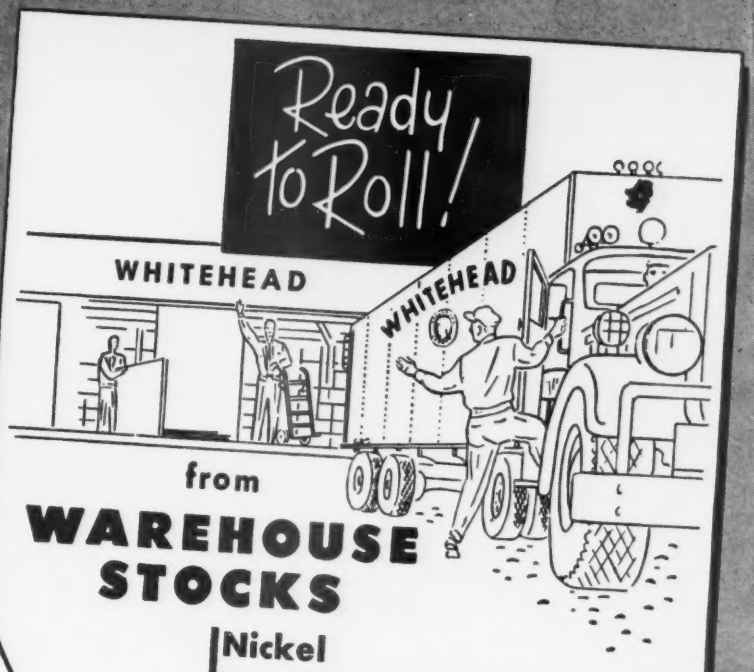
Garrett Supply Co., a division of Garrett Corp., both of Los Angeles, will distribute air tools of the Aro Equipment Co., Bryan, O., in the southern California area.

Harsch Bronze & Aluminum Foundry, Cleveland, suffered $100,000 damage by fire Dec. 1.

And NOW—

★ *Foundry* **MOLYBDENUM**

We are proud to announce the addition of Climax Foundry Molybdenum to the Whitehead line of foundry alloys. Now you can get 'Moly' in quantities from handfuls to carloads, at mill level prices from your nearest Whitehead warehouse.



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And, while you have Whitehead on the phone, take advantage of our technical service department. Our foundry engineers will be happy to answer any questions you may have on alloying problems, or otherwise work with you in any way they can.

For higher quality castings, use higher quality alloying materials. And get them fast—Call Whitehead.

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Man to Man

By RALPH L. LEE

Popular Science for Foundry Folks

"We need a flock of translators who speak not only the scientific lingo, but also the language used by 90 per cent of foundrymen"

BY golly, I'll say it in front of anybody—I don't care how much more book learning he has than I—"I pour pretty good iron in the Lee Hobby Foundry." At least, it's turned out all right for what I wanted to cast—most of the time, I mean.

Through sad mistakes, the cut-and-try method and by questioning old-timers, I've learned that if I use too much steel scrap in my charge or keep on melting the same old iron over and over again, I'm more than likely to end up with machining trouble. And it's getting so now that I can tell pretty well from the looks of the iron as it comes out of the spout whether it's hot enough to run fairly thin sections or just about right for sash weights. I toss a little ferrosilicon into the ladle if I think it will do some good, and I have some graphite and some nickel.

Copying what I've seen big foundry melters do, I cast the old eagle eye over a fracture and guesstimate the grain size and chill depth just for the heck of it or to show off in front of company a bit. So, all in all, I feel pretty good about the melting situation in the Lee Hobby Foundry and fairly confident when I'm laying the kindling on the bottom that I'm going to get some iron.

In spite of this cozy picture, I'm far from being satisfied, for I know from what I hear that a lot of new things are being tried and learned. The research boys are turning up a lot of new wrinkles I'd like to get the hang of. The trouble is that I get so fouled up with the technical language most of these experts use that I can't quite get the drift of what they're talking about. This throws me into quite a tizzy when I realize that no matter what words they use, they are talking about the very same metals, heat and other stuff I work with all the time.

At first I thought that I was unusually backward when it comes to scientific talk, but after confessing my ignorance to others who spend all their time supplying molten metal to the foundry, I found that most of them were not much better off than I.

Although I have no statistics to lean on, I wouldn't be a bit surprised to find that 90 per cent or more of the folks actually doing the melting for the industry couldn't tell a eutectic from a dendrite even though they had a whole ladleful.

We all realize, of course, that any group of folks who specialize in a particular field is bound to invent words for use among themselves which mean absolutely nothing to outsiders. Shop talk among medical doctors is almost impossible for laymen to follow. Nuclear physicists in a huddle can have one whale of a time talking protons, neutrons, electrons and isotopes with little danger of run-of-the-mine eavesdroppers stealing their stuff.

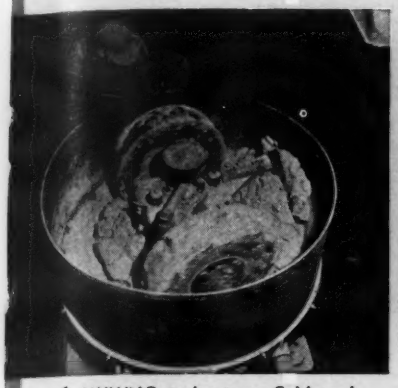
So there is little wonder that metallurgists pow-wowing among themselves over eutectics, ferrite, austenite, pearlite, martensite, cementite, carbides and what-not might just as well speak Chinese as far as most working foundrymen are concerned. And all of this, it seems to me, is perfectly natural and just as it should be—that is, for birds of a feather. But when it comes to birds of one particular feather sharing what they have learned with birds of another particular feather, then something's got to give. One or the other has to learn a new language. It would seem that the smaller group involved should give in to the larger for the greatest benefit of all.

Many years ago I was dragged out of my engineering work (I didn't want to go) and shoved into the job of holding sales schools for the very first crop of Frigidaire salesmen. It occurred to me that a salesman would never be able to do his best until he understood why a Frigidaire couldn't help producing cold in the summertime. I was warned that the theory of refrigeration was so technical that the average salesman would never get it through his head, even if he wanted to. I came close to agreeing when, in an effort to get the principle through my own thick skull, I started floundering around through the only textbooks available on the subject. I couldn't get to first base until some of my better schooled friends told me what the scientific words meant. After I began to get the hang of them, I was tickled pink to find that the basic principle of mechanical refrigeration wasn't over my head at all. So on the basis of my understanding, using the most unscientific illustrations that were ever used, I prepared an explanation that anybody could understand. To prove it I tried it out on the girls in the office, with all due respect to their intelligence.

You could have knocked me over with a feather when the chief engineer insisted that I give this very same presentation to an assembly of our entire engineering staff, which included some of the best refrigeration authorities in the country. From this experience I learned that no one

PROVED SUPERIOR

ACME RESIN



1 MULLING, tacky stage. Cold sand, liquid resin, and catalyst are charged into a standard muller.

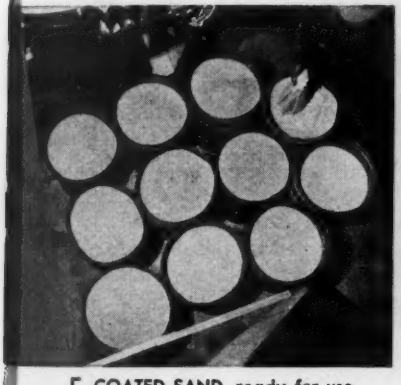
2 MULLING, free-flowing stage. Each grain of sand *uniformly coated* —no critical control necessary.

3 DISCHARGING. Sand is *dust-free*, cannot segregate from resin, green strength is controllable.

4 TWENTY-POWER magnification of resin-coated grains of sand after mulling process.

PlastiSand® PROCESS

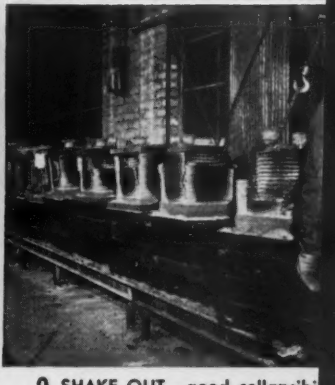
Resin formulation and the coating process covered by Patents 2,706,163 *and* 2,706,188



5 COATED SAND, ready for use. Extremely *high tensile strength* at resin contents of from 2% to 4%.

6 BLOWN SHELL CORES. *Non-segregating* qualities lend themselves perfectly to shell and core blowing techniques.

7 STACK POURING of Alnico magnets, 12 to 16 high. 2% of resin produces necessary *high strength*, saves time and space.



8 SHAKE OUT—good collapsibility makes for easier shake out and better cleanup.

Pictures courtesy Mr. Raymond Kelly, Superintendent, Arnold Engineering Foundry, Marengo, Ill.

PROVEN MULLERS ON THE "COLD PROCESS"	SIMPSON "Mix-Muller" BEARDSLEY & PIPER "Speed-Muller" and "Mulbarow" BAKER-PERKINS "Unidor" CLEARFIELD "Muller"
PROVEN MULLER ON THE "HOT PROCESS"	BEARDSLEY & PIPER "Shell-Sand Speed-Muller"

PLASTISAND Process utilizes a revolutionary new method for coating sand with liquid-resin for foundry shell molding.

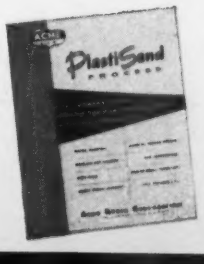
This new development by Acme Resin Corporation in the field of shell molding has several positive advantages that overcome the primary deterrents to the use of the more widespread "C" or shell molding process.

Foundries using the PLASTISAND Process report PROVED SAVINGS, PROVED SAFETY and PROVED SUPERIORITY of molds with as little as one-half the resin content formerly necessary with dry resin.

With the PLASTISAND Process, a shorter dwell is possible and a faster cure is assured, from a shorter time on the pattern and a faster baking cycle.

Acme's new PLASTISAND Process is adaptable to dump-box, roll-over and blowing of either shells or cores. It uses either hot or cold mulling—in both, Acme liquid resin is used.

An informative folder has been prepared to better acquaint the foundry industry with the new PLASTISAND Process. It may be obtained by writing to the ACME RESIN Corporation at the address listed here.



ACME RESIN CORPORATION

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ever need to be afraid of insulting the intelligence of real experts by explaining anything in words of one syllable. In fact, I heard later that many of the engineers had a much better picture of the principle of refrigeration as a result of my unscientific speech.

Facing me right now are two 5-ft library shelves packed solidly with books on foundry subjects. In my filing cabinet, back in the closet, is almost as much material in the form of bulletins, society transactions and copies of speeches and papers which have been given to foundry groups. And, as we all know, a lot of foundry research is going on right now that will find its way into printed form later.

All of this is wonderful, but I can't help thinking that unless this valuable dope leaks out from between the covers which bind it and seeps into the heads of the bulk of our foundry folk, who make castings, our research can hardly be expected to pay for its keep.

As I understand it, our splendid Foundry Educational Foundation is devoted primarily to the preparation and education of folks we hope will come into the industry or become our future customers. Unless I'm talking through my hat, I see a wonderful opportunity for enlightening the folks we've already got, who are pretty important, too.

It seems to me we need a flock of translators who speak not only the scientific lingo fluently, but also the language used by 90 per cent of the foundry family, and without an accent. These translators, as I see it, first will cull out of our library all of the material tailored to fit the needs of the handful of scientists and such and then take the dope our rank and file folks can use and should have and will do a good job of translating.

Can't you just imagine sort of a popular science series for foundry folk, without one special purpose word in the series, all devoted to basic fundamentals? I can see slide films, motion pictures and charts especially made for our own people. Then I also see groups of folks—small groups in little foundries and big groups in big foundries—sitting together while they get the facts of life about metals, heat, heat travel and internal plumbing in molds—the principles I mean, not all the embroidery.

Yessirree Bob, I see an educational catalyst for bringing together foundry facts and the rank and file of our foundry folks.

Investment Casting Booklets

A booklet describing an easy method of evaluating approximate cost of parts to be produced by the investment casting process has been issued by Engineered Precision Casting Co., Box 68, Matawan, N. J. Copies are available for $1 each. Also available, without charge, is a 24-page booklet entitled "Castability—Its Effect on Alloy Selection for the Investment Casting Process."

HOW TO DO IT

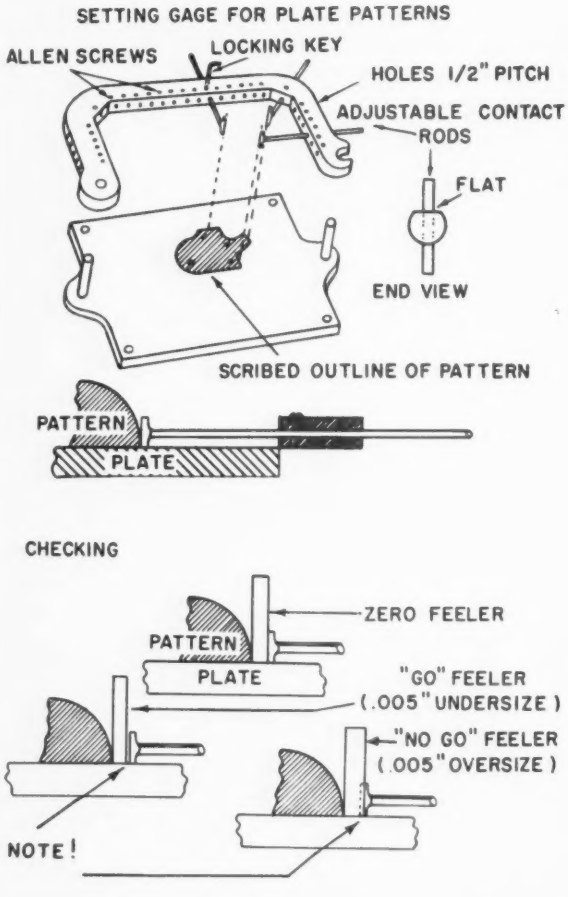
Cast Aluminum Gage Helps Locate Pattern Halves on a Plate

By A. H. SQUIRE
Sutton Coldfield
Warwickshire, England

PATTERN locating gage consists of a U-shaped cast aluminum frame with a hole at the tip of one leg of the U and a slot at the other to fit locating pins on the pattern plate. Smaller holes, parallel with the face of the U gage are drilled at regular intervals around the frame. Flat-sided contact rods are slid through these holes and held in desired position by screws mounted in the top face of the gage frame.

In use, the gage is placed over pins in the plate on which a pattern half has been fixed in the desired place. Three or four of the sliding rods are adjusted to contact key faces of the pattern, and tightened in position with the screws. Then the gage is removed and placed either on the other side of the same plate or on a different plate, if a pair is to be used. In the second position the gage is reversed to suit the opposite "hand" of the other half pattern. Second half of the pattern is placed against the contact rods and fixed in position.

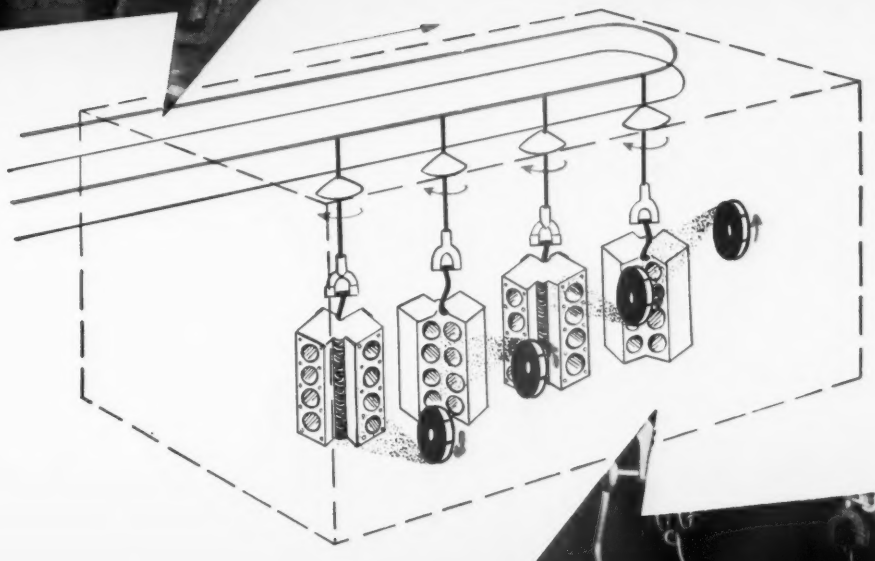
Pattern location may be checked by inserting zero, "go" or "no go" feelers between the pattern and contact rods.



Do you have any tricks of the trade tucked away with your foundry experience? Why not release them to fellow foundrymen? FOUNDRY will pay a minimum of $15 for each idea submitted and published. Send a photo or drawing with your idea.

10 Tons Per Hour Cleaned in this Wheelabrator Cabinet

non-stop blast cleaning



CUTS CLEANING TIME 50%

By consolidating their cleaning operations into a single Wheelabrator Monorail Cabinet, Superior Foundries, Inc. of Cleveland has cut cleaning time 50% and reduced the cost of repair parts 40%. All the work formerly done in three tumbling mills and two 14' blast tables is now cleaned in this machine at a saving of 15,000 man hours yearly.

The Wheelabrator Cabinet—a 2 pass, indexing, spinner-hanger type—cleans 10 tons of castings per hour in a steady flow without downtime for loading and unloading. Work hangers of special shapes and types carry a variety of castings, ranging from 5 lbs. to 600 lbs., each, within the blast stream of four Wheelabrator units. The work rotates within the blast of each unit for one minute to thoroughly clean even the most intricate castings.

The savings that can be made by consolidating cleaning efforts in Wheelabrator Cabinets are described in a 32-page Application Brochure. Ask for Catalog No. 724.

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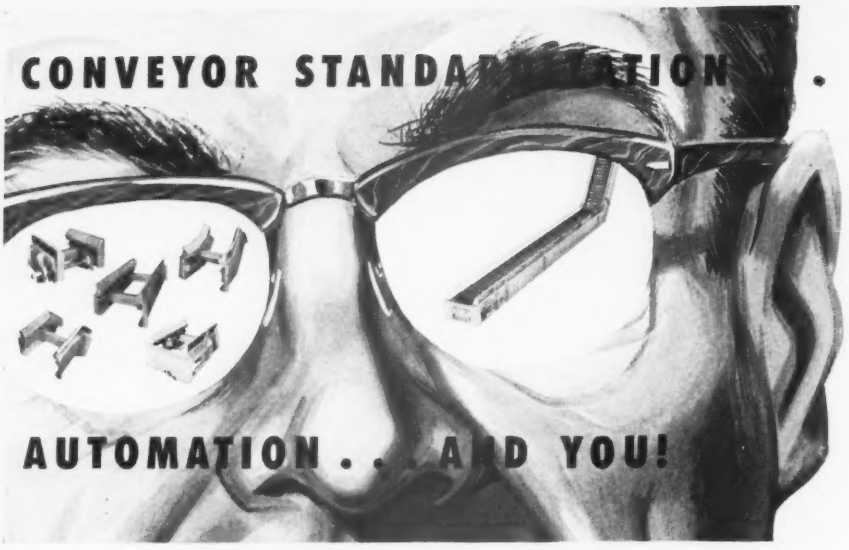

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The five standard sections shown can be assembled to form virtually any type of *"customized"* conveyor for the handling of stampings, formed metal parts, forgings, automotive scrap, chips and turnings.

Straight sections . . . concave or convex sections . . . take-up charge and discharge-end sections can be furnished to meet specific requirements of belt width as well as load bearing and volume capacities.

A single glance at the MAY-FRAN conveyor standardization program, and you will see savings never before possible. In addition you will see unsurpassed conveyor flexibility.

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Meditations of a Sandman

By HAROLD E. HENDERSON
H. C. Macaulay Foundry Co.
Berkeley, Calif.

PERMEABILITY, according to the AFS *Foundry Sand Testing Handbook,* is "that physical property which permits gas to pass through the molded mass of sand." The definition is clear and concise.

Foundrymen always have known that molded sand must be permeable, and they have resorted to various expedients to make it so. From my observations, however, it would appear that each has his own, rather nebulous opinion of the degree of permeability required and of just what it means in his practice.

We have means and methods of determining base, green, dry and baked permeability, but we know little about *hot permeability*—and in the final analysis, this property is the only one that affects casting results.

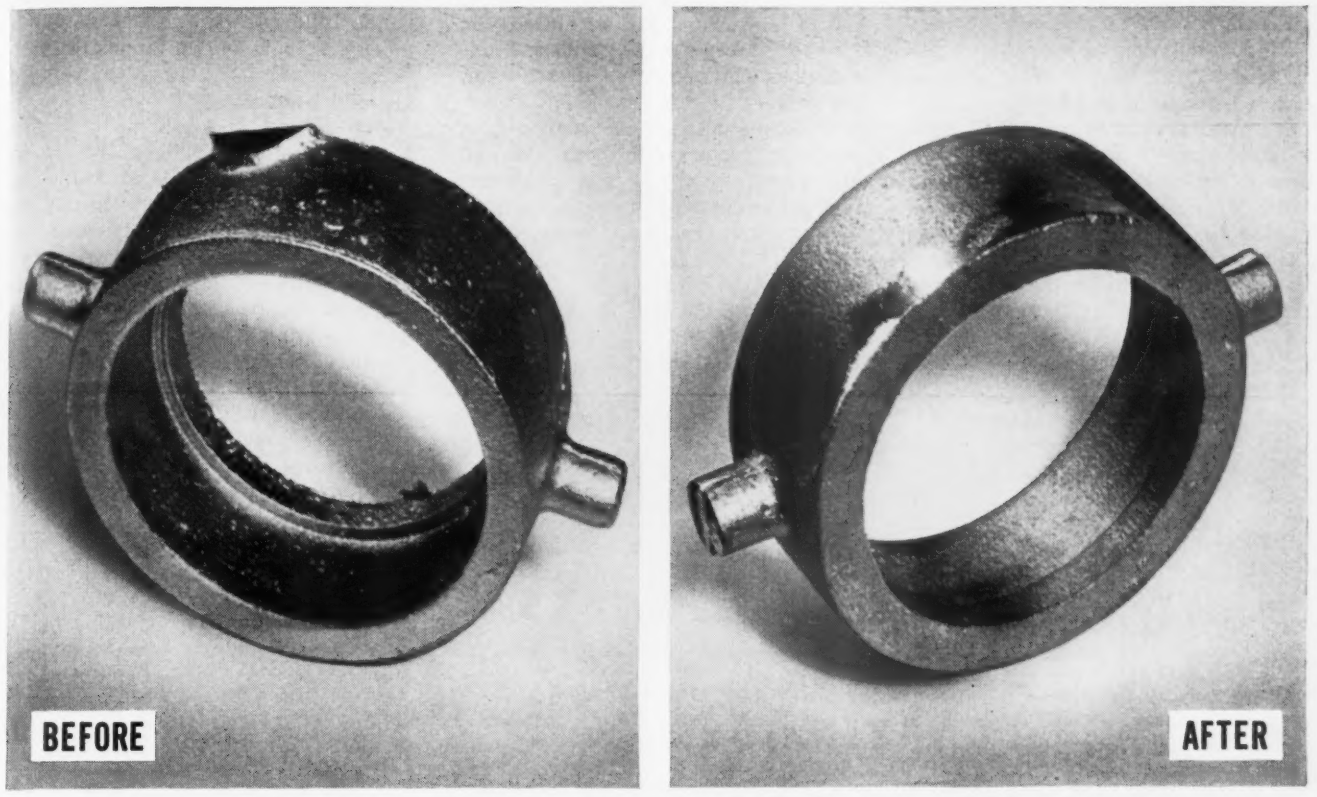
The great majority of small foundries throughout the world regard permeability as they do the weather—that is, as a very changeable thing over which they have no control. Even shops with sand testing equipment usually have no means of fines removal or even of dust exhaust. When permeability is considered too low, they resort to additions of a coarser grain sand, and at least 40 per cent of this is required to effect the upward climb.

This remedy is worse than the disease it was intended to cure, for casting finish is affected adversely. Of course, the old tricks still may be employed: Tucking, soft ramming, dry backing-sand, and liberal use of the vent wire—practices hardly compatible with this machine age.

Why is it that a naturally bonded sand, high in gas-producing potentials, containing up to 9 per cent moisture, with a perm as low as 20, can produce good castings, whereas a synthetic mix with 5 per cent bentonite and a perm ranging from 100 to 250 must be worked at approximately 3 per cent moisture to give us a saleable product? Where we have the highest perm, we seemingly have the least need for it.

I recognize the fact that a fine sand, high in clay and combustible matter, requires more water to make

3M METHOD—better from start to finish



New Jersey foundry increases production 66% with 3M Abrasive Belts

3M Abrasive Belts *are long-lasting production tools, designed to do the best grinding and finishing job at lowest cost to you.*

J. Rohm & Sons Co., Kenilworth, N.J., obtained this production increase when they switched to the 3M Abrasive Belt Method for removing excess gate and riser stock from this tough, bronze casting. This company formerly used hard wheels, grinding only 30 castings per hour. When the 3M Method was installed, using Three-M-ite Resin Bond Cloth Belts, production jumped to 50 units per hour with lower unit costs, less operator fatigue, and greater safety. 3M Abrasive Belts can help you increase production, too. Your 3M Representative is an abrasives expert who can show you how the 3M Abrasive Belt Method can work best in your foundry. Send coupon today for facts.

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it workable, but why should a relatively clean sand, producing little gas, require high permeability?

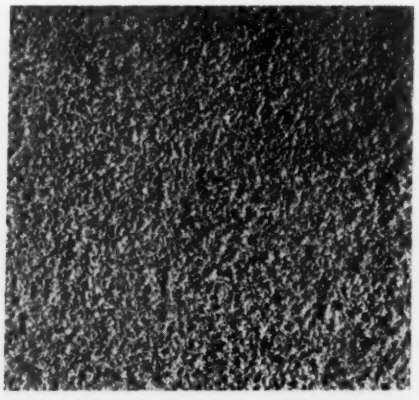
A permanent mold made of cast iron has a perm presumably rated at zero. From this, I would assume that where there is no mold gas, an impermeable mold is practical. Is it illogical then to reason that the degree of permeability required should be in direct ratio to the amount of gas to be expelled? I have always thought that if one were cutting a hole in the wall to let the cat in and out, he would not need to make the hole any larger than the cat. Of course, if the cat were being chased by a dog, it might be well to make extra allowance, a sort of margin for error or safety—but I would still advise keeping the hole smaller than the dog.

The time element in escape is a pertinent factor with both cat and gas, especially if the gas originates in a core which is surrounded largely by metal, but that is another problem. I am here discussing green molding sand as used in an iron foundry.

I cannot avoid the feeling that we have a great deal to learn about the behavior of sand, during both pouring and the cycle of solidification which follows. Have we placed too much emphasis on the importance of permeability? Is moisture control our primary problem?

Going from the sublime (a very fine sand), to the ridiculous (coarse sand-blast sand), I decided to see just how far I could go with a high-perm molding material. My sand selection could almost be classed as gravel, since 96 per cent of the sample did not pass the No. 20 mesh screen. After I added 5 per cent of western bentonite and 3 per cent water, the perm was 1000 plus, just how much "plus" I'll never know, for my meter couldn't register it. Green compressive strength was 4 lb.

If anything in a foundry ever felt like wet, sticky gravel, that was it! As I was about to discard the mess. I wondered, "If fine sand produces a smooth finish, how rough will it be with this stuff?" I decided to find out.



This surface of a step-plate was obtained by using a 40 AFS sand, 5% western bentonite and 3% water

Using a piece of ¼-in. plyboard 6 in. wide and 2 ft long as my pattern, I faced it on the drag side with about an inch of this super-perm conglomerate, backed it with regular heap sand and rammed hard. Upon drawing the pattern. I had a degree of visible porosity that would be difficult to describe: Not exactly Swiss cheese, but plenty open. I then began to debate with myself as to just how deeply my hottest iron could penetrate this surface? I expected from ¼ to ½ in. of penetration.

It actually amounted to less than 1/16-in. After sand-blasting — and very much to my surprise—I had what appeared to be a serviceable, nonskid step-plate, and I decided to use it for that purpose. The rough or working face was chilled exceptionally hard, with coarse grains of silica sand uniformly distributed and embedded in the surface.

EC&M MAGNETS HANDLE CASTINGS . . .

HOT FROM THE SHAKE-OUT TABLE

Production picks up when EC&M ALL-WELDED Lifting Magnets are on the job . . . in charging tumbling barrels . . . removing risers from sand . . . making up cupola charges . . . for sweeping clean incoming cars of pig iron or scrap. EC&M Magnets are ALL-WELDED . . . magnetic circuit is efficient . . . pole shoes keep tight . . . coil space is of better proportion.

Get the facts on EC&M ALL-WELDED Magnets. Write for Bulletin 900-F showing 15 circular sizes, and quick-discharge controllers.

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MELTRITE PIG IRON

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More used than any other merchant pig iron, MELTRITE is made to the required analysis to meet the specifications for many different grades.

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IRON ORE • PIG IRON
COAL • COKE • FERROALLOYS

Under a 20-power glass, it was like Tiffany's window. Under the heavily shod feet of 100 foundry workers, it wore like—well, like iron—hard iron! This plate has resisted its daily punishment for almost 10 years and shows no appreciable wear.

We decided to use this *stepping* on all of our foundry stairs and had suitable patterns made. These were of ¼-in. material 6 in. wide and of lengths suitable for our various wooden stairways. The patterns were boarded, two to a mold, and side-gated. Five or six countersunk screw-holes required regular molding sand, as did the cope and the joint gating surface. We decided however, that the sand-blast sand was much coarser than necessary and turned to an AFS No. 40 grain size, which provided a more attractive surface, yet certainly could qualify as a "nonskid" surface.

MARCH OF DIMES

FIGHT INFANTILE PARALYSIS

JANUARY 3-31

This sand was of an angular grain, with 22 per cent on the 35 screen, 36 per cent on the 48 and 26 per cent on the 65. We continued to add 5 per cent bentonite and 3 per cent water and mulled for only three minutes. The perm reading on this mix was approximately 450. Green strength was 5.3 lb and moisture 3.2 per cent. Not more than ¼-in. of this mix was used as facing. Molds were rammed to about 80 hardness and were poured with gray iron from 2600 to 2700° F.

From an experiment intended solely to reveal the extent of metal penetration in a high-perm sand, I had produced what I considered to be a satisfactory step-plate. Not being hard to satisfy, I stopped there. A more ambitious and more inquisitive soul might have been inclined to carry the experiment a bit further. I'm sure the results would have been interesting.

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Symbol of Coke Quality

MILWAUKEE COKE SOLVAY

MILWAUKEE SOLVAY is made from carefully selected coal purchased for one purpose only—to make the best foundry coke.

It is highly resistant to shatter and abrasion, consistently high in carbon and low in sulphur and ash, carefully screened to size, and always in dependable supply.

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Obituary

CLIFTON W. SHERMAN, founder and chairman of the board of directors, Dominion Foundries & Steel Ltd., Hamilton, Ont., died Nov. 24. Mr. Sherman was born in Essex County, N. Y., and entered the steel business as a blast furnace operator. He founded Dominion Foundries in 1912 and was president until 1945, when he became chairman of the board.

Earl F. Oyster, 72, well known engineer in the foundry equipment field, died in Cleveland Dec. 8. He was associated with Osborn Mfg. Co., Cleveland, from 1914 until 1935, when he resigned as chief engineer to help organize SPO Inc., Cleveland. In 1941 he became chief engineer, William H. Nicholls Co., Richmond Hill, Long Island, N. Y., returning to SPO Inc. two years ago as staff engineer.

James Prochaska, 72, for over 25 years foreman of the foundry department, Eberhard Mfg. Co., Cleveland, division of Eastern Malleable Iron Co., died Nov. 17. He was graduated from Case Institute of Technology. Following retirement from the foundry industry, he served with Naval Ordnance Bureau during World War II and the Korean conflict.

E. L. Graham, 78, founder and former president, Acme Foundry & Machine Co., Coffeyville, Kans., died Nov. 29. He was a patternmaker for United Iron Works at Pittsburg, Kans., and served as superintendent of its Cherryvale and Independence, Kans., plants until 1914, when he organized the Acme foundry. He served as its president and general manager until 1947.

Albert H. Quitman, 83, for 50 years general foundry foreman, Yale & Towne Mfg. Co., Stamford, Conn., died Nov. 6, following recent retirement. Mr. Quitman followed his father as general foreman of the company.

Pierre Charlette, 87, founder and former vice president, Charlette's Foundry, Blackstone, Mass., died Nov. 9. He entered the foundry business in 1903 and retired in 1948.

Harold S. Sharp, 67, since 1942 president, Sharp Heating & Supply Co., Cleveland, died Dec. 8. For 23 years prior to heading the heating company Mr. Sharp was vice president of the former Henry Furnace & Foundry Co., Medina, O.

William F. Steffen, 63, for the past 15 years foundry foreman, Wisconsin Gray Iron Foundry Co., Milwaukee, died Nov. 19.

John Goucher, 40, owner of Chicago Heights Gray Iron Foundry Co., Chicago Heights, Ill., was killed Nov. 20 in an automobile accident.

Charles C. Penrose, 70, since 1940 general manager, Dunham Co., Berea, O., died Dec. 1. Mr. Penrose attended Oberlin College and prior to joining Dunham Co., was associated with Ferro Machine & Foundry Inc., Cleveland.

Crane Institute Moves Offices

Offices of the Electric Overhead Crane Institute are being transferred from New York to Washington, and Joe H. Peritz has been appointed executive secretary. Mr. Peritz was formerly manager of dealer sales for Lamson Corp., Syracuse, N. Y. During the Korean emergency he was chief of the Material Handling Branch, National Production Authority.

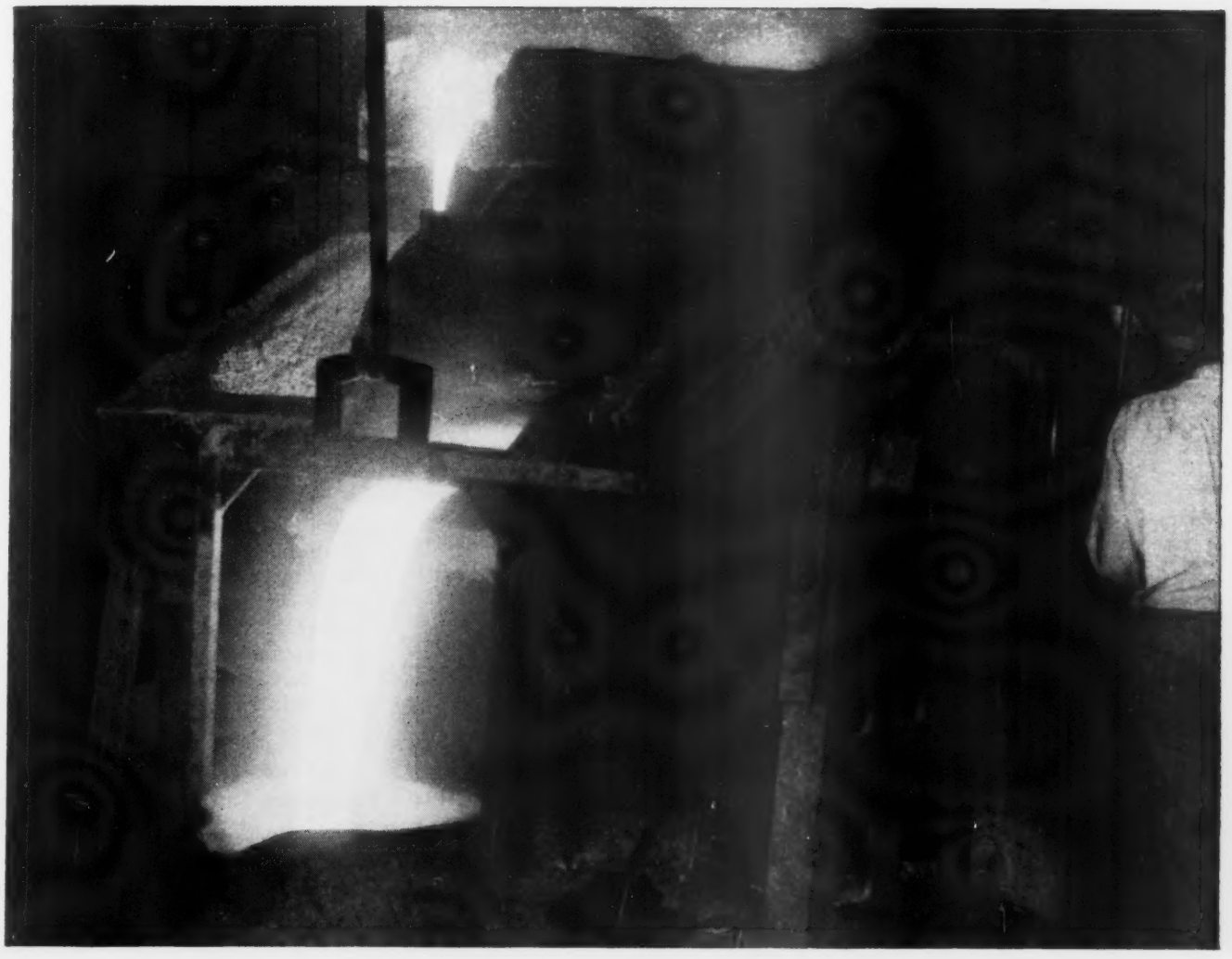
GRAY IRON IMMORTALIZES MANDY

GRAY iron has immortalized Mandy, the mule which furnished the locomotive power for one of the first trolleys between El Paso, Tex., and Juarez, Mexico, around the turn of the century. The mule was cast life-sized by Grubbs Foundry, El Paso, from a pattern made by Texas Western College students Howard Hoffman and James Goodman.

Production of the 2100-lb cast iron replica was complicated by a couple of problems. First, the student patternmakers had trouble with Mandy's ears. Mandy was a small Spanish mule, and they didn't want her to look as though she were from Missouri. Then, after the first mold had been made, it was washed away in a flood last July which covered the floor of the foundry. The mold was completed again, and the statue was cast in one piece, but for the ears.

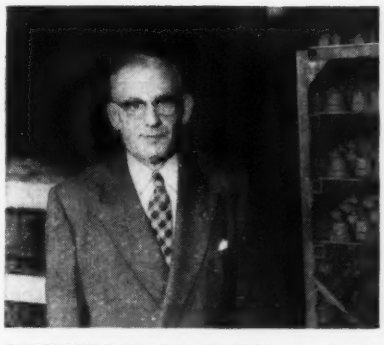
The iron mule then was painted properly and hitched up to Mule Car No. 1, a restored streetcar that was pulled through El Paso streets from 1882 to 1902, when electric streetcars took over. At that time, the original Mandy was placed on a float and paraded through the city to the cheers of thousands of onlookers.

On Sept. 14, 1955, her cast iron likeness and Mule Car No. 1 made their last trip through El Paso streets, mounted on a truck and escorted by a sheriff's posse. In a colorful ceremony attended by many of the city's oldtimers, Mandy and the mule car were presented to the city and placed on permanent display in San Jacinto Plaza. There they symbolize a bygone era in transportation.



"20% faster-drying . . . Cities Service core oil increased production, lowered costs"

Enot Foundry uses Cities Service No. 62 Core Oil for all cores, from 5 ounces to 5000 pounds



SURROUNDED BY CORES stands H. Sleicher, Treasurer in Charge of Sales. Having just switched to Cities Service No. 62 Core Oil, he reports it dries 20% faster, increases production, lowers costs.

Located in Wayne, Michigan, Enot Foundry is one of the oldest foundries in the State and has enjoyed continuous operation under the same management since its formation in 1921.

With a melting capacity of 50 tons per day, Enot turns out automotive, machine tool, and business machine castings, as well as many others . . . castings from 5 ounces to 5000 pounds! Yet for every one, Enot uses the same core oil . . . Cities Service No. 62!

Says H. Sleicher, Treasurer in Charge of Sales: "Not only does Cities Service No. 62 eliminate the need for many different core oils, it also dries 20% faster than previous oils and has consequently increased production. In addition, blows have been practically eliminated and we find that we use less oil per core, thus saving on costs."

In foundry after foundry, the story varies but the praise continues . . . praise for Cities Service Core Oil. Find out why. Call in a Cities Service Lubrication Engineer. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

Foundry Developments

By EDWIN BREMER
Metallurgical Editor

MORE and more attention is being given to removal of hydrogen in steel to eliminate the defects attributed to presence of that element. Procedures include use of oxygen which, while primarily employed to reduce carbon content, also aids in removal of dissolved gases; use of argon flushing and employment of dry air flushing. In the latter, the air should have a dew point of at least minus 40°F. Polytetrafluoroethylene, a solid composed of 76 per cent fluorine and 24 per cent carbon, also is found effective in hydrogen removal.

Low Thermal Expansion

THAT the thermal expansion of certain cobalt-iron-chromium alloys is extremely low and nearly constant between 20 and 60°C (68 and 140°F) has been confirmed by the National Bureau of Standards. Work on thermal expansion and phase transformation studies on a number of these alloys by Peter Hidnert and Richard K. Kirby indicate that an alloy containing 36.6 per cent iron, 8.9 per cent chromium and remainder cobalt has a coefficient of expansion of less than 1×10^{-6} per degree C in the 20 to 60°C range. However, the alloys are very sensitive to small variations in chemical composition, and further study is necessary to determine the practicability of the alloys in commercial applications.

Bombards Graphite

REMARKABLE changes in the physical properties of graphite occur when it is exposed to chain-reaction bombardment in atomic reactors, according to Dr. W. Kelly Woods, General Electric Co., Richland, Wash. Under selected conditions the strength of artificial graphite doubles, it expands in volume and its ability to conduct heat decreases fifty-fold. However, as far as reactor use is concerned, the damage can be reduced by proper choice of method of graphite manufacture and by increasing the temperature at which the graphite is maintained within the reactor during the neutron chain reaction. While studies of irradiation effects on graphite have a direct application in design and operation of nuclear reactors, another important result is their contribution to fundamental knowledge of physics, according to Dr. Woods.

Finds the Culprit

RECENT article in our overseas contemporary, *Foundry Trade Journal*, Oct. 27, 1955 issue, discusses spasmodic occurrence of blowholes in gray iron castings not attributable to the usual sources of gas defects, such as venting or rather the lack of it, damp areas, etc. Microscopic examination of some of the holes prior to cleaning revealed minute greenish glassy beads which, when a sufficient number finally were collected, showed an average composition of 36.2 per cent MnO, 41.0 per cent SiO_2, and nil CaO. Slag developed in the ladle had a similar composition when the trouble occurred.

Further it was found that when materials charged had a Mn content over 0.9 per cent and particularly when the final Mn rose above that figure, slag and blowhole trouble developed. Also slag analyses showed that an increase of sulphur in the metal was accompanied by an increase of MnO in the slag, and increasing the Mn charged did not have any marked effect in reducing final sulphur content in the metal, unless an increase simultaneously was made to the limestone addition. If that increase was not made, gassy metal was produced. This led to the suggestion that when high-sulphur-bearing materials are being used, it is wiser to increase the CaO content of the cupola slag, and leave the Mn alone.

Super Duper

SUPER-STRONG perfect crystals of a wide variety of metals can be made by the same process discovered several years ago to make perfect crystals of iron, according to General Electric scientists. These metals include gold, silver, copper, nickel, platinum and cobalt. The process uses a high concentration of the metal in the form of a gas obtained either by chemical means or by boiling the metal. A recent development in the field is a method of measuring the tensile strengths of the perfect crystals which are "whiskers" only about 0.001-in. thick. The method involves placing the whisker in a vertical position and imbedding the upper end in a glass-like substance heated to the melting point. When cooled, the latter grips the top of the whisker. Bottom similarly is attached to a glass cylinder floating in a container of oil. Syphoning oil from the container applies a load to the whisker, and the elongation and eventual breaking are projected on a screen for viewing. Perfect crystals of copper withstand a tensile strength of 600,000 psi, compared with ordinary annealed copper's 30,000 psi.

Technique Important

RAMMING technique in forming monolithic roofs for electric furnaces is important to attain the best life. In addition to obtaining uniform density of the refractory mix, the ramming operation should be conducted so that any laminations resulting will be perpendicular to the hot face. One operator suggests applying the rammer at an angle of approximately 45° to the face to approach those conditions.

Rolling Increases Life

NEW technique developed by the Rolls Division, Blaw-Knox Co., Pittsburgh, indicates that through its use the life of cast steel back-up rolls will be increased substantially and failure from breakage in the fillet will be reduced considerably. Procedure involves cold rolling the fillet to increase tensile strength where stress concentration, resulting from geometric proportions of the roll, is greatest. By increasing tensile strength the fatigue limit is increased proportionately. Cold rolling also may impart a compressive strength which minimizes fatigue stresses. The cold rolling impaction tool is comparatively simple, consisting of a wheel, positioning apparatus and gage to register the amount of pressure being applied to the roll fillet.

BASIC NEWS
FOR CUPOLA OPERATORS

Basic Refractories offers field service to foundries

Cupola operators interested in adopting a basic practice can get refractory information and assistance from Basic Refractories' engineers. These men know refractory application and are familiar with cupola practice.

CONVERTING FROM ACID TO BASIC CUPOLA OPERATION INVOLVES CHANGING ONLY LINING IN MELT ZONE AND WELL

Replacing the acid lining in these two areas involves a comparatively simple changeover. And maintenance is easy after the basic lining has been installed.

Usual procedure is to place an insulating material or a course of fireclay brick next to the cupola shell. Then one or two courses of basic brick are installed to complete the permanent lining.

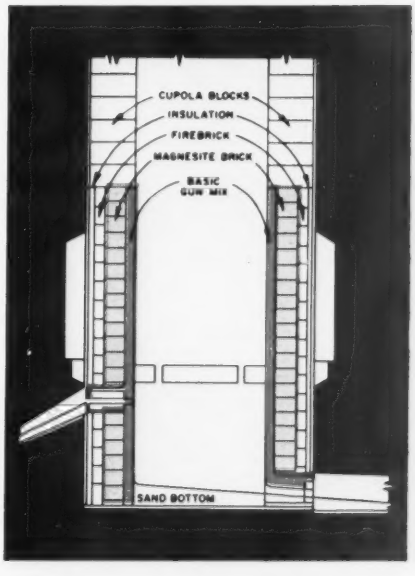
The height of the melt zone area determines the height to which the basic brick should extend above the tuyere level. This varies in each cupola. Usually a basic lining 60 inches above the tuyere level is adequate. Insulation next to the shell is desirable to avert excessive heat loss, since the thermal conductivity of magnesite brick is much greater than that of fireclay brick.

When brickwork has been completed, a fire is built in the cupola to completely remove moisture. After the bottom is dropped, brickwork should be covered with 2 or 3 inches of GUNDOL. This forms the working surface of the basic lining. It should be emplaced by a refractory gun specifically designed for this purpose.

Sand can be used to form the bottom of a basic-lined cupola and is usually better than basic materials, since it will not "hang up" when the bottom is dropped.

The slag hole of a rear slagging basic cupola is subject to severe chemical and mechanical erosion. GUNDOL can be used to install the slag hole quickly and easily. It is installed by either shooting or ramming the refractory around a pipe or rod the diameter of the desired hole.

With proper operation of the cupola, the tap hole of a rear-slagging basic lined cupola is almost trouble-free. Forming the tap hole with GUNDOL is convenient and saves time, since both it and the slag hole can be installed while the lining is being repaired with the gun.



Maintaining Basic lining is easy

Replacing brick work is seldom necessary if the cupola is properly maintained. And with the BRI Gun and GUNDOL, maintenance is easy and less time consuming.

GUNDOL, a basic gun refractory made by Basic Refractories, Inc., is a carefully controlled mixture of specially prepared dead burned dolomite and hydration resistant dead burned magnesite. To this, small amounts of chemicals are added as bonding agents.

---

8 advantages of Basic cupola operation

Basic lining and repair materials initially cost more than acid. But these costs are offset by the following advantages:

1. **Lower sulphur content in the iron produced**
2. **Greater carbon pickup**
3. **Steel scrap can be substituted for high-cost low-phosphorous pig iron without lowering the total carbon content of the iron produced**
4. **Lower cost metal charges can be used**
5. **Less scrap castings**
6. **Better pouring characteristics of metal**
7. **Absence of bridging and clean drop**
8. **Higher metal tap temperatures**

BASIC REFRACTORIES INCORPORATED

845 HANNA BUILDING · CLEVELAND 15, OHIO

REFRACTORIES ENGINEERING AND SUPPLIES LTD — EXCLUSIVE CANADIAN AGENTS

New Equipment and Supplies

Portable Grinder: Cleco Division, Reed Roller Bit Co., 5125 Clinton Dr., Houston 20, Tex.—Lightweight, pneumatic cup wheel grinder weighs 10½ lb and is 7⅝ in. high. Its rotor is of ground alloy steel floating on the shaft, eliminating assembly of the motor unit. Cylinder is of high-carbon steel with smooth inside surfaces to reduce friction and wear. Sealed ball bearings permit a high axial thrust loading. Grinder can use either a straight type abrasive wheel with the guard attached to the grinder body or the flanged cup abrasive wheel with the revolving cup guard. Grinder-attached guard is removable without affecting the motor assembly.

For More Details Circle No. 1—Page 177

Curing Agent: Shell Chemical Corp., 50 West 50th St., New York 20, N. Y.—Low-viscosity, high-boiling, liquid curing agent for use with epon resins is for use in room temperature contact pressure laminating. In such applications, its low viscosity wets out the glass cloth and develops a strong laminate. A concentration of 25 per cent of the curing agent, based on the weight of the resin used, provides the optimum cure, according to the manufacturer. At this concentration, a wet lay-up contact pressure laminate will be tack free in about four hours at room temperature.

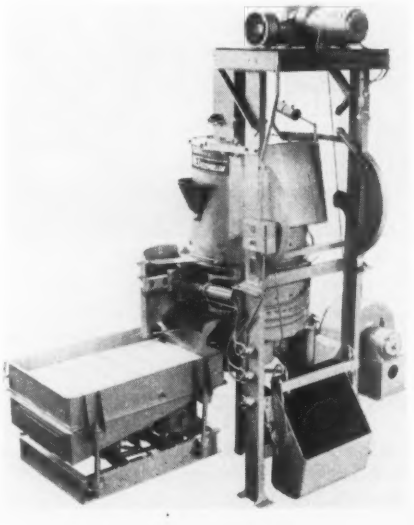
For More Details Circle No. 2—Page 177

Thermocouple: Thermo Electric Co., Saddle River Township, Rochelle Park P.O., N. J.—Thermocouple with platinum 30 per cent rhodium—platinum 6 per cent rhodium calibration is capable of measuring temperatures up to 3272° F. Manufacturer reports the extended temperature range does not sacrifice sensitivity or corrosion resistance of the instrument.

For More Details Circle No. 3—Page 177

Shell Sand Mullers: Beardsley & Piper, Division of Pettibone Mulliken Corp., 2424 North Cicero Ave., Chicago 39, Ill.—Muller is available in six sizes with capacities from 2000 to 9000 lb per hour for cold process mulling of free-flowing, nonclumping, resin-coated shell molding sands. Mullers operate on a total cycle time of about five minutes on all typical resin-coated sand mixtures. Units are available as complete packages with all auxiliary equipment and controls ready to do a complete job. According to the manufacturer, the operator has full control over all the variables of cold process preparation.

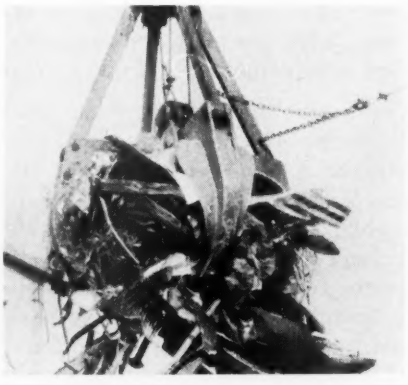
For More Details Circle No. 4—Page 177



Hydrogen Determinator: Ledoux & Co., 359 Alfred Ave., Teaneck, N. J.—Hydrogen determinator based upon the combustion technique determines concentrations as low as 0.003 per cent in wide variety of metals including Ti, Zr, Ce, Ta, Mo, W, Ni, Co and their alloys. No vacuum is required. Manufacturer says method is reproducible and accurate. Instrument also can be used to determine carbon and sulphur.

For More Details Circle No. 5—Page 177

Grapple Magnet: M. P. McCaffrey Inc., 2131 East 25th St., Los Angeles, Calif.—Combination grapple and magnet are engineered into an integral unit for handling baling material, loose material, prepared scrap or for clean-up. Four pointed tines



penetrate into all types of scrap metal, holding it firmly while being carried. Grapples weigh about 2300 lb. Magnet weighs 1100 lb. It may be used as a magnet or as a grapple—or both at same time.

For More Details Circle No. 6—Page 177

Trolleyphones: Femco Inc., Irwin, Pa.—Communications system for industrial applications provides two-way conversation between fixed stations and operators of moving equipment, or between operators of two or more units of moving machinery, without conventional wiring of a permanent telephone system. Units operate on frequency-modulated carrier current and derive energy from existing trolley wires or plant power lines.

For More Details Circle No. 7—Page 177

Palletized Abrasive: National Metal Abrasive Co., 3560 Norton Rd., Cleveland, O.—Metal abrasives for

For More Details on These Items
Use Reply Card—Page 177

cleaning applications are packaged in 50-lb cartons, 40 to each pallet, to simplify unloading, storage, inventory control and use. Size and type of abrasive is plainly marked on each package to aid in correct

selection from inventory. Pallets are expendable. Manufacturer reports there is no waste or spillage loss as cartons do not snag easily. Abrasives are supplied in a variety of hardness ranges for different blast cleaning applications.

For More Details Circle No. 8—Page 177

Leak Checker: Peerless Electric Co., Electronics Division, Warren, O. —Instrument provides a method of detecting molten or gaseous leaks in thermocouple protection tubes immersed in liquid materials. Instrument uses the conductivity of molten or gaseous salt or metal to indicate leaks. Warning circuit connects the thermocouple lead wire with the bath tank. Molten material leaking into the protection tube from the tank closes the circuit. Test voltage is applied to the circuit. If a leak has closed the circuit, current flow lights a warning light.

For More Details Circle No .9—Page 177

Aluminum Solder: Ultralloy Corp., Room 1018, 53 West Jackson Blvd., Chicago 4, Ill.—Aluminum solder is for bonding aluminum to copper, brass and other nonferrous metals. Solder contains no aluminum, cadmium, lead or antimony, requires no flux, is highly resistant to corrosion and reportedly retains its original color after application. It can be used for refining and restoring patterns and coreboxes and repairing die castings.

For More Details Circle No. 10—Page 177

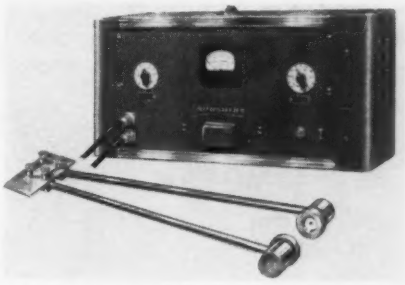
Laminating Resin: Furane Plastics Inc., 4516 Brazil St., Los Angeles 39, Calif.—Epoxy paste laminating resin can be applied to a variety of surfaces. Material is mixed with a hardener and brushed on surfaces to be protected or built up. Glass cloth is pressed into place roughly by hand, followed by a squeegee or roller applicator. Paste rapidly penetrates and thoroughly soaks the glass fabric. Manufacturer reports the material has shown versatility in lamination of fiberglass jigs and fixtures.

For More Details Circle No. 11—Page 177

Burner Controls: Combustion Control Division, Electronics Corp. of America, 718 Beacon St., Boston, Mass.—Panel control systems are said to offer complete burner protection and fully automatic operation for commercial-industrial oil, gas and combination oil/gas burners. Flame failure safeguard, programming control, short circuit protection, motor starters, fuel selector switches, signals and alarms are combined in a single, integrated panel.

For More Details Circle No. 12—Page 177

Void Detector: Sunshine Scientific Instrument, 1810 Grant Ave., Philadelphia 15, Pa.—Ultrasonic void detector consists of a frequency-modulated transmitter and receiver to produce a sonic sound beam through a test piece in a tank of oil or water. Detector locates voids in laminar metals, plastics, weldments or castings. Buzzer signal can be adjusted to be used as a Go-No Go signal for quality control. An indicating meter provides a visual percentage reading of the void signal.



For More Details Circle No. 13—Page 177

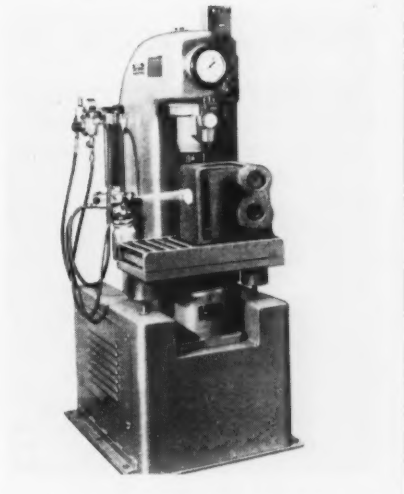
Power Cylinders: Miller Fluid Power Co., 2040 North Hawthorne Ave., Melrose Park, Ill.—New cylinder features designed to provide longer cylinder life, improved performance and wider usage have been adopted as standard and are available on company's complete line of

Hardness Tester Has Paint Spray Attachment

BRINELL HARDNESS tester contains a paint spray attachment synchronized with its testing cycle so that relative hardness of parts is automatically indicated by a spot of paint. With the arrangement, sorting of pieces is done in effect by the machine rather than by the operator.

Tester is designed to fit into a roller conveyor system. Castings are rough ground top and bottom and rolled into place. When cycle start button is actuated and brinell ball descends toward casting, roller section drops, leaving casting firmly seated on three hardened anvils, one of which is immediately below the penetrator. Impression is made and, if acceptable, a spot of paint is automatically sprayed on the casting. After a predetermined interval, the load is released, penetrator retracts and rollers lift so operator can roll the casting down conveyor to next operation.

Brinell limits are adjustable to meet with user's requirements. While the machine pictured is a single-purpose unit with a fixed



vertical opening, other models are available with adjustable openings to handle a variety of work. Spray units can be cycled with acceptable range or can indicate "too hard" or "too soft" specimens. The tester is manufactured by Steel City Testing Machines Inc., 8817 Lyndon Ave., Detroit 38, Mich.

For More Details Circle No. 14—Page 177

air and hydraulic cylinders. Features are chrome hardened, chrome plated piston rods, rod wipers, hydraulic rod seals and black ferric oxide surfaces.

For More Details Circle No. 15—Page 177

Telephone Amplifier: Remler Co., 2101 Bryant St., San Francisco, Calif.—Three-ounce telephone ampli-

fier powered with dime-sized batteries clips over any style telephone receiver and can be used anywhere to step up volume to high audibility. The pocket-size electronic device is a reproducing receiver and a three-stage amplifier with small transistors taking the place of tubes. It is said to increase the acoustic output of telephones by 49 decibels.

For More Details Circle No. 16—Page 177

Files: Simonds Saw & Steel Co., Fitchburg, Mass.—Expanded line of files can be supplied for every need including machine shop, diemaking, patternmaking, foundry and other special applications. Pattern files and rasps, holders, rotary files and burrs in carbide and high speed steel are included in the line.

For More Details Circle No. 17—Page 177

Improved Packaging: Frederic B. Stevens Inc., Detroit 16, Mich.—Use of polyethylene drum liners in

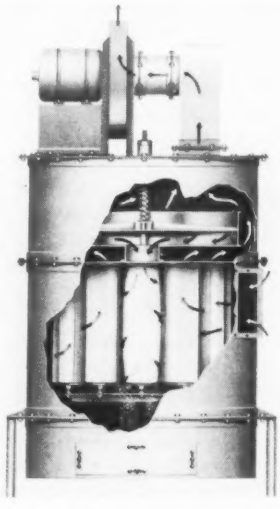
packaging company's mudding and joint sealer compounds, permanent mold coatings and paste type core and mold coatings has provided several benefits: Paste products are preserved indefinitely against drying out; products can be stored clean and free from dirt and contamination; partly used contents can be protected by folding liner over material; containers do not rust through and all contents can be used by lifting liner from the container.

For More Details Circle No. 18—Page 177

Floor Patch: Colonial Refining & Chemical Co., 817 NBC Bldg., Cleveland 14, O.—Floor patching material can be applied over wet floors and reportedly forms a permanent bond with the existing floor. Once it sets, manufacturer claims it will not chip or crack. Material is supplied in powder form and is mixed with water. Maximum setting up time is four hours. Floors repaired with the material can be put back into use within 24 hrs.

For More Details Circle No. 19—Page 177

Dust Filter: Day Co., 810 Third Ave. N.E., Minneapolis 13, Minn.—Dust filter employing principle of high-velocity reverse air cleaning



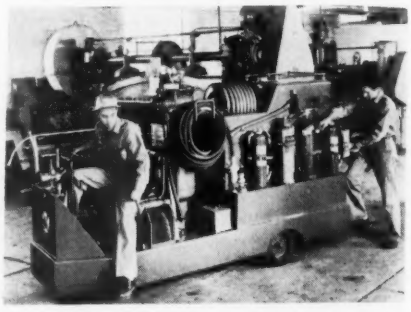
can handle air volumes up to 1200 cfm. Air travels through felted filter media, depositing dust on outside of filter sleeves. Surge of air from indexing collar and drum forces dust from sleeve. Clean air is carried to atmosphere or returned to plant through exhaust fan located at top of filter. Unit employs 12 filter sleeves. By mounting on casters the unit can be made portable. Filter can be furnished for pressure or vacuum operation.

For More Details Circle No. 20—Page 177

Fuel Oil Filter: Auto-Flo Corp., 14590 Schaefer Highway, Detroit 27, Mich.—Fuel oil filter features zinc die cast filter bowl and cap, reportedly the first application in the heating accessory field to use zinc die castings. Filter bowl is of one-piece construction designed with an annular section and bolt cast in a rib-reinforced inside bottom. Oil coming through the inlet port passes through a felt disk cartridge and fine mesh screen cylinder core of electro-galvanized 40 mesh wire cloth before it can flow to the outlet port and into the burner supply line. Two models are available, a standard and a "king size."

For More Details Circle No. 21—Page 177

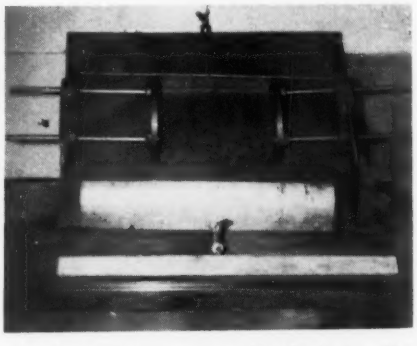
Fire Trucks: Ansul Chemical Co., Marinette, Wis.—In-plant fire trucks, available in six models, are designed



to carry fire fighting equipment especially adaptable to needs of plant fire brigades. Accessories available include ladders, utility bar, light, hose, portable fire extinguishers and nozzles, all mounted with quick-release brackets. An accessory cabinet provides storage for fire blankets, boots, air masks, coats and first aid kits. Trucks are 10 ft long and 5 ft 8 in. high in either a three-wheeled 42 in. wide chassis or a four-wheeled 48 in. wide chassis.

For More Details Circle No. 22—Page 177

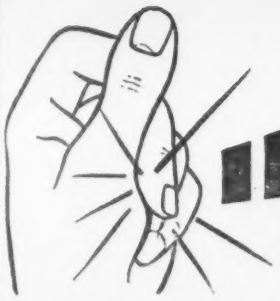
Coremaking Template: William Bey, 3403 West 97th St., Cleveland, O.—Coremaking template equipment is said to eliminate full or skeleton half-coreboxes for production of certain types of cores with circular, square, hexagonal or other geometrical cross sections. Unit consists of a base plate with clamping devices on each side for supporting adjustable guide rods. Templates of the de-



sired contours are attached to the guide rods and rest on a suitable drier plate. Sand is packed between the two templates and shaped to the desired form by use of a strike bearing simultaneously on both templates.

For More Details Circle No. 23—Page 177

Pressure Gage: U. S. Gauge Division, American Machine & Metals Inc., Sellersville, Pa.—Pressure gage



IDEAS FOR FOUNDRYMEN

HERE ARE QUICK REVIEWS OF NEW LITERATURE—available to foundrymen as "idea" and reference information. Readers in the United States and Canada may obtain copies by using the attached cards. Readers in foreign countries should write direct to the manufacturer offering literature.

81. Pattern Wood

Aetna Plywood & Veneer Co., 1731 Elston Ave., Chicago 22, Ill.—Characteristics and specifications of laminated plies of Honduras mahogany impregnated with phenolic resin-forming chemicals to provide dimensional stability to wood die models and patterns for green sand and shell molding are presented in bulletin.

82. Refractories

Ramtite Division, S. Obermayer Co., 2563 West 18th St., Chicago 8, Ill.—Catalog illustrates and describes materials and methods for installing plastic and castable refractories, cements and mortars in foundry ladles, crucible furnaces, reverberatory aluminum melting furnaces and mixer ladles.

83. Abrasive Belt Grinding

Engelberg Huller Co., 831 West Fayette St., Syracuse 4, N. Y.—"How Abrasive-Belt Grinding Increases Production" presents 46 illustrated case histories of platen, contact wheel, formed wheel, centerless and flexible belt grinding applications covering a wide range of materials.

84. Safety Clothing

Johns-Manville, 22 East 40th St., New York 16, N. Y.—Booklet, "Asbestos Safety Clothing," describes various articles of safety apparel including asbestos suits, helmets, aprons, leggings, overshoes, gloves and mittens.

85. Vacuum Furnaces

High Vacuum Equipment Corp., 349 Lincoln St., Hingham, Mass.—Vacuum furnaces for melting, heat treating, sintering, annealing, brazing, degassing and purification of metals and alloys are described and illustrated in catalog 552

86. Materials Handling

Nutting Truck & Caster Co., 1201 West Division St., Faribault, Minn.—Catalog 56G illustrates 49 different models of two wheel and platform trucks, 12 types of dollies and 15 styles of casters. Application photos and complete specifications of each item are included.

87. Furnaces

Surface Combustion Corp., Toledo 1, O.—Furnaces for heating and heat treatment of aluminum and other light metal alloys from ingot to finished product are described in bulletin SC-171. Soaking pits, coil annealers, continuous process roller hearth furnaces, batch type units for heat treating, melting and investment casting also are discussed.

88. Blast Cleaning

Wheelabrator Corp., 505 South Byrkit St., Mishawaka, Ind.—Illustrated catalog 724 provides applications of specially designed airless blast equipment to 56 production cleaning problems. Descriptive drawings accompany photographs of each application. Performance figures are given for specific cases.

89. Radiography

High Voltage Engineering Corp., 7 University Rd., Cambridge 38, Mass.—Bulletin R contains photographs, performance curves, tables, bar charts and line sketches emphasizing the importance of radiography as an inspection and quality control tool.

90. Bonding Clay

Baroid Division, National Lead Co., Railway Exchange Bldg., Chicago 4, Ill.—Physical characteristics and general information on bonding clay for use in mold and core mixes and with fire clay to line ladles and furnaces are found in bulletin.

91. Valve Positioner

Barber-Colman Co., Wheelco Instruments Division, Rockford, Ill.—Bulletin F 5991-1 describes an automatic valve positioner for use with any control instrument having "high" and "low" contact with a neutral position

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unit corrects for variations in heat requirements due to changes in furnace load, control settings, air and fuel pressure, Btu values or combustion efficiency in batch type operations.

92. Heat-Resistant Products

Rolock Inc., 1350 Kings Highway East, Fairfield, Conn.—Over 200 illustrations and descriptions of heat and corrosion resistant products are in catalog. Sections on furnace muffles, furnace trays and fixtures, retorts and pit-type furnace equipment, and pickling, processing and plating equipment are included.

93. Vacuum Degasser

Kinney Mfg. Division, New York Air Brake Co., 3640 Washington St., Boston 30, Mass.—Bulletin 402 describes mobile vacuum degasser for purifying molten metals. Component parts, dimensions and seven specific advantages offered to foundry operators are covered.

94. Magnetic Drive

Electric Machinery Mfg. Co., Minneapolis 13, Minn.—Advantages, construction features, dimensions and detailed information on magnetic drive that provides adjustable speed power for a wide range of applications is found in bulletin 4400-PRD-229.

95. Cranes

Whiting Corp., Harvey, Ill.—Photographs, explanations of major components, dimensions, drive assemblies, clearances and capacities of overhead traveling cranes are provided in catalog 86.

96. Iron Foundry Alloys

Vanadium Corp. of America, 420 Lexington Ave., New York 17, N. Y. —Brochure lists compositions of principal alloys used by iron foundries with an analysis of their recommended uses.

97. Compressor

Allis-Chalmers Mfg. Co., General Machinery Division, Milwaukee 1, Wis.—Two-stage sliding vane type compressors for air, gas handling, drilling and other applications are described in bulletin 16B8244.

98. Fluxes

Cleveland Flux Co., 1026 Main Ave., N. W., Cleveland 13, O.—Instructions for use of bronze, aluminum, red or yellow brass fluxes are found in bulletin 46-A.

99. Conveyor Carriers

Stephens-Adamson Mfg. Co., Aurora, Ill.—Bulletin 355 covers line of standard belt conveyor carriers as well as a number of special units, trippers and accessories.

100. Soda Ash

American Potash & Chemical Corp., 3030 West Sixth St., Los Angeles 54, Calif.—Informational folder on soda ash contains data regarding production, various grades, distribution and other material pertaining to industrial applications.

101. Metallic Stearates

Witco Chemical Co., 122 East 42nd St., New York 17, N. Y.—Bulletin 55-2 outlines properties and uses of metallic stearates. Calcium stearate has found application in powder metallurgy and in foundry parting compounds. Also has been used as a release agent in formation of sand shells to enable shell cores to be removed readily from the mold.

102. CO_2 Binder

Brumley-Donaldson Co., 3050 East Slauson Ave., Huntington Park, Calif. —Folder provides charts, illustrations and general data on the use of binders, sands, washes and pastes in conjunction with the CO_2 process. Effect of various sands on flowability and a comparison of strengths of two sands are covered in some detail.

103. Dust Collection

American Air Filter Co., 215 Central Ave., Louisville 8, Ky.—Bulletin 270-A1 provides illustrations and general information on dynamic precipitator and hydrostatic precipitator type dust collectors with volumes up to 50,000 cfm.

104. Polishing Head

Grinding & Polishing Machinery Corp., 2530 Winthrop Ave., Indianapolis 5, Ind.—Brush-backed polishing head for sanding, polishing, deburring, blending, smoothing, scratching or roughing applications on all types of surfaces is illustrated and described in bulletin 102.

105. Heating Plan

Fageol Heat Machine Division, R. D. Fageol Co., Kent, O.—Bulletin LL-2268 details heating system which reportedly eliminates duct work, piping, radiation, diffusers and other components of large central heating units.

106. Refractories

Carborundum Co., Refractories Division, Perth Amboy, N. J.—Leaflet 5132 describes use of super refractories in nonferrous melting furnaces. Twelve types of melting units are illustrated.

107. Exhaust Fans

American Blower Corp., 8111 Tireman St., Detroit 4, Mich.—Construction features, performance data and installation drawings of exhaust fans for heavy duty applications are found in bulletin 6514.

108. Wax Injection Presses

Alexander Saunders & Co., 95 Bedford St., New York 14, N. Y.—Bulletin gives specifications and operating details on several wax injection presses for investment casting. Illustrations are included.

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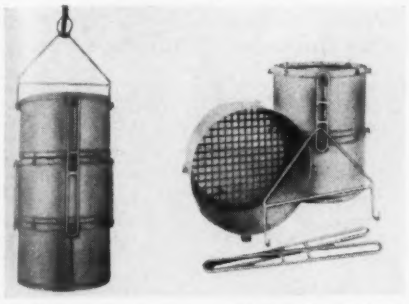
permits tapping of an air hose at the tool to determine pressure available at the tool regardless of original pressure or number of tools on the line. Gage is 2 in. in diam, finished in chrome and is equipped with a hypodermic needle and guard.

For More Details Circle No. 24—Page 177

Heat Treating Basket: Wiretex Mfg. Co., 40 Mason St., Bridgeport 5, Conn.—Stacking type heat treating



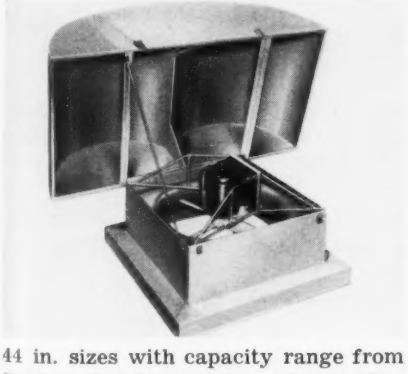
basket can carry a 2½-ton load into a pit furnace and is designed to withstand temperatures up to 2200° F. Baskets are made of Inconel throughout. Each basket has four stacking guides and four lugs to which a lifting device is fitted. Complete unit of three baskets weighs 1200 lb. Baskets are 34½ in. ID x 22 in. deep.

For More Details Circle No. 25—Page 177

Fire Extinguishers: Walter Kidde & Co., Belleville, N. J.—Wet chemical portable fire extinguishers in new line include a 2½-gal pressure-operated combination water and antifreeze unit, a 2½-gal and 5-gal pump type units using either stainless steel or copper containers and 1-qt, 1½-qt, and 1-gal carbon tetrachloride extinguishers and chlorobromomethane extinguishers which are pressurized with either air or nitrogen to 150 psi. All pressurized units have a safety latch.

For More Details Circle No. 26—Page 177

Roof Ventilator: Hartzell Propeller Fan Co., Piqua, O.—Reversible roof ventilator moves air in either direction with almost equal efficiency. Fan is made in 28, 36 and



44 in. sizes with capacity range from 5500 to 23,600 cfm for exhaust. The intake operation range is 5340 to 22,300 cfm. Ventilator can be supplied in all sizes for flat roof, slope roof or peak installation. Optional equipment includes wire mesh intake guards and motor or manually operated dampers.

For More Details Circle No. 27—Page 177

Air Filter: Emco Pneumatic Corp., 1317 Locust St., Des Moines, Iowa—Lightweight, fully automatic, self-adjusting air filter is made of aluminum, weighs 12 oz and requires no manual adjustment. Filter prevents sludge, abrasive substances, rust, scale and moisture from entering air-operated tools. Aluminum parts are treated with a chromate coating to surpass a 100-hr salt water spray test. Unit has a range of 1 to 20 cfm. Its operating range is from 60 to 250 lb air pressure.

For More Details Circle No. 28—Page 177

Sprocket Rim: Babbitt Steam Specialty Co., Babbitt Square, New Bedford, Mass.—Adjustable sprocket rim with chain guide has been redesigned to incorporate spider and

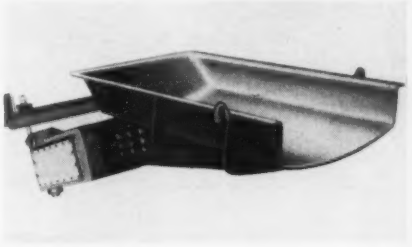
rim into one casting. Redesign reportedly increases the strength factor to a degree that will satisfy all reasonable requirements. Uses of the rim are found wherever inaccessible valves require chain wheel operation as in control of flow of steam, water, gas or oil or on hoppers, chute gates, sluices or silos.

For More Details Circle No. 29—Page 177

Exhaust Tester: Davis Emergency Equipment Co., Instrument Division, 55 Halleck St., Newark, N. J.—Portable precision instrument for measuring oxygen and combustibles in exhaust is designed to meet special testing requirements of diverse industries using different kinds of combustion processes. Oxygen is measured by catalytic combustion, employing a disposable container of propane. Results are registered on a scale with two ranges—0-5 per cent and 0-21 per cent. Combustibles are measured in a separate cell and are indicated on an individual meter, also with two ranges—0-3 per cent and 1-15 per cent. Both can be read simultaneously.

For More Details Circle No. 30—Page 177

Vibratory Feeder: Syntron Co., 540 Lexington Ave., Homer City, Pa.—Dust-tight design feature incorporated in vibratory feeder is said to protect against dusty atmosphere or



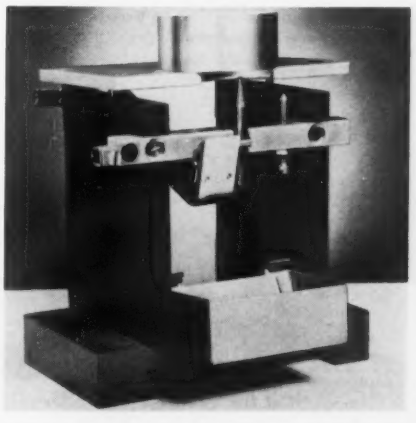
supply hopper spillage that might impair smooth feeding action of unit's electromagnetic motor drive. Leaf spring ends are covered on each side of the base casting. Metal plate covers armature and core. Feeder has a 48 x 60 in. flat pan trough with a maximum capacity of 500 tons per hour.

For More Details Circle No. 31—Page 177

Floor Topping: Monroe Co., 10703 Quebec Ave., Cleveland 6, O.—Abrasive filler and aggregate combined with a synthetic, heavy bodied plastic base material and special solvents are said to make safety floor topping a nonslip and nonskid surface. When applied on steps, inclines and floors it forms a thin coating that is slip-proof, wet or dry. Material can be troweled on and can be used over concrete, wood, steel, tile, mastic or terrazzo surfaces.

For More Details Circle No. 32—Page 177

Spectrograph Accessory: Bausch & Lomb Optical Co., 635 St. Paul St., Rochester, N. Y.—Spectrograph accessory stand is designed to

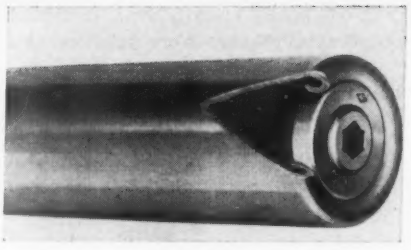


speed spark techniques in spectrum analysis of irregularly shaped samples. Stand will hold any shaped sample such as disks, bars or small

parts having at least one flat surface that will rest on the platform provided. Stand clamps on the illuminating unit bed of the company's spectrographs. In operation, samples to be analyzed are placed on the platform and an electrode is held below it. When current is applied, the spark leaves a charred spot on the metal surface, but does not destroy the sample piece.

For More Details Circle No. 33—Page 177

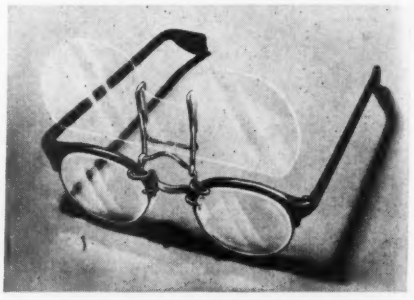
Conveyor Roller: Alvey-Ferguson Co., Cincinnati 9, O.—Integral end conveyor roller is mounted on



self-contained ball bearings housed in ends which are rolled inward to present smoothly rounded end surfaces. Rounded lip design deflects products on and off roller conveyor lines without gouging by roller ends. Design offers extra strength with no increase in weight. To meet variable requirements, plain, dust-tight and grease-sealed types are available. Two models—2½-in. diam, 14-gage steel and 2¼-in. diam, 16-gage steel—can be supplied.

For More Details Circle No. 34—Page 177

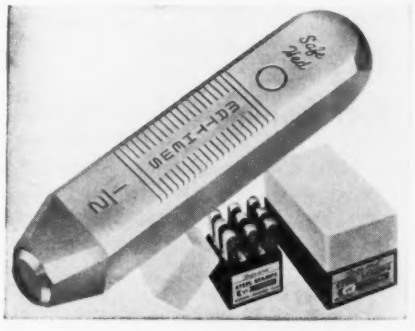
Spectacle Clip: Kimball Safety Products Co., 9310 Wade Park Ave., Cleveland 6, O. — Spring clip holds safety spectacles or protective shields



of clear or tinted plastic. It snaps in place on all types of prescription lenses. Clip is adjustable to three positions—up, out or down. For wearers of prescription lenses, the clip is reported to afford positive protection in welding and grinding operations and make ideal sun glasses for outdoor wear.

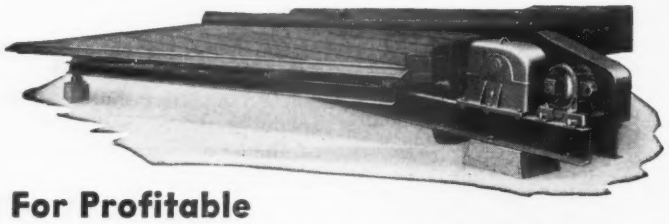
For More Details Circle No. 35—Page 177

Steel Stamps: Jas. H. Mathews & Co., 3942 Forbes St., Pittsburgh 13, Pa.—Steel hand stamps feature engineered serrations running horizontally across two sides of the stamps held between the thumb and fingers during the marking operation. This feature is said to position the fingers correctly at their best point for stress-free, secure holding. The top of the shank is beveled to prevent mushrooming of the head from impact of hammer blows.



For More Details Circle No. 36—Page 177

Power Wheelbarrow: Prime-Mover Co., Muscatine, Iowa—Power wheelbarrow of ¾-ton capacity is 64 in. long, 31½ in. wide to permit movement through any standard



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*10% in the case of Permabrasive
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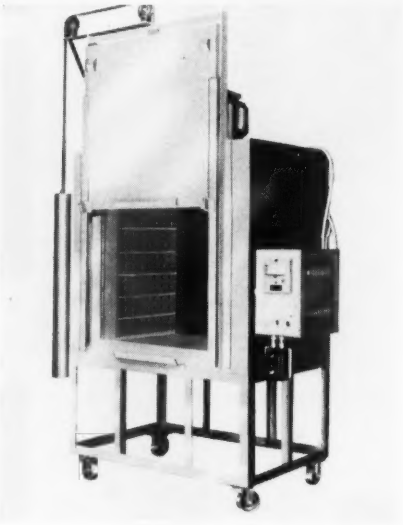
doorway or aisle. Bucket has rounded corners with 10 cu ft capacity (liquid level) and up to 18 cu ft heaped. Two sizes of flatbeds adapt the unit for carrying solid materials. All beds are interchangeable on same chassis. Recoil starter, large fuel tank, sealed-in lubrication and one piece engine hood are said to minimize and simplify maintenance.

For More Details Circle No. 37—Page 177

Pre-Heat Ovens: Blue M Electric Co., 138th & Chatham St., Blue Island, Ill.—Automatic forced air recirculating ovens designed for preheating and stress relieving of magnesium, aluminum and newer alloys feature



mobility, diagonal air flow and exact temperatures up to 1000° F. Ovens are supplied in two standard sizes of 18 and 36 cu ft working space for either 230 or 440 v, single or three-phase operation. Cabinets are reinforced heavy gage steel with triple sidewalls. Ovens are equipped with automatic electronic indicator and controller and/or time-temperature programmer. Excess temperature protection may be included.

For More Details Circle No. 38—Page 177

Chilling Unit: Cincinnati Sub-Zero Products, 3930 Reading Rd., Cincinnati 29, O.—Low-temperature chilling unit is capable of chilling 250 lb of tool steel from +80° F to −120° F per hr. Chilling chamber is 18 in. wide x 33 in. deep x 48 in. long constructed of electric-welded pressure-tight galvanized steel. Total chamber capacity is 16 cu ft or 110 gal. Machine is used in heat treating alloy steels where low temperature quenching is required to achieve transformation of austenite to martensite. Low temperature also is used for normalizing and stress relieving of nonferrous castings.

For More Details Circle No. 39—Page 177

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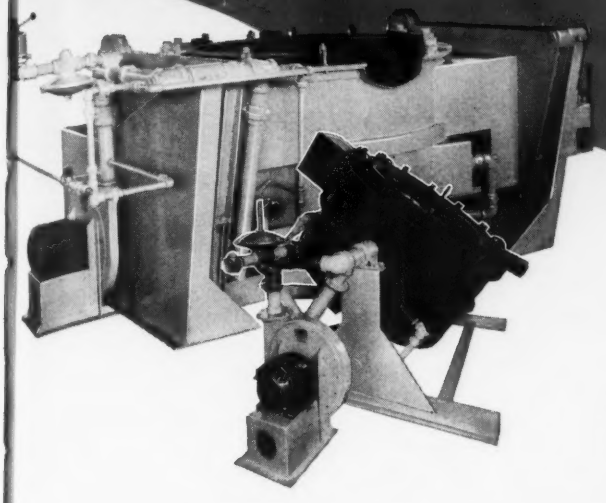

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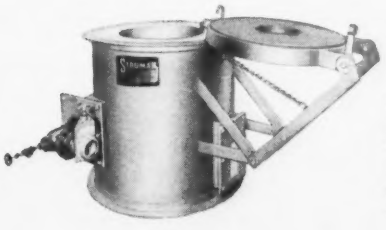

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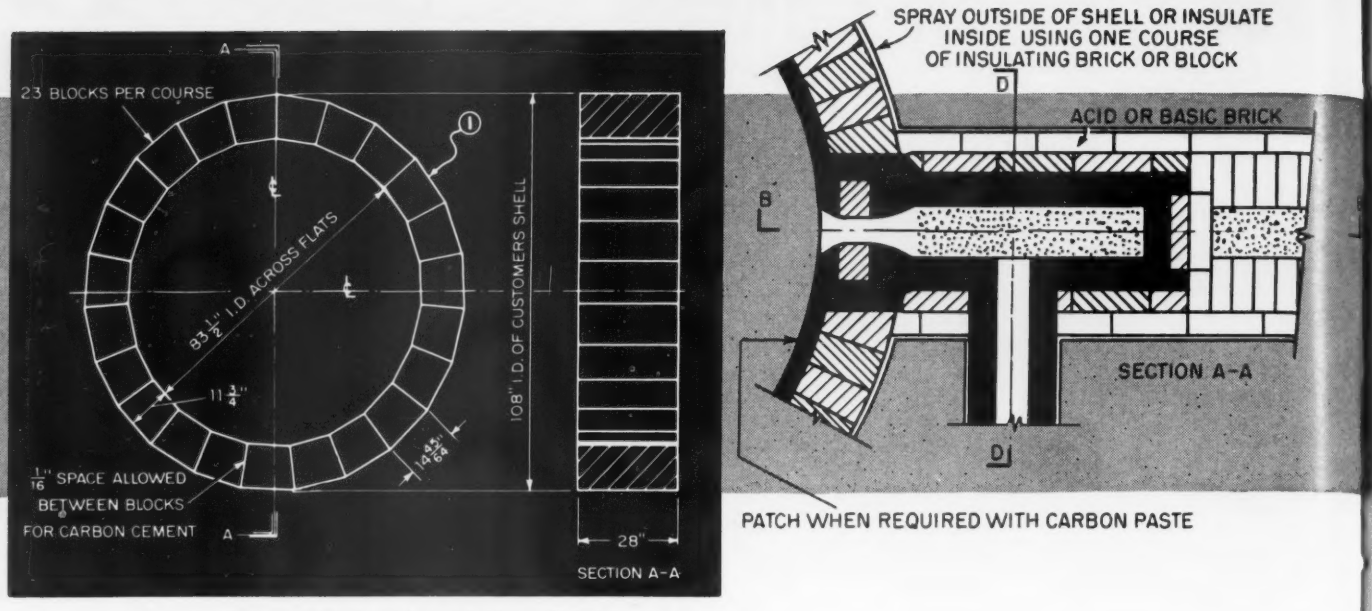
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1/16" SPACE ALLOWED BETWEEN BLOCKS FOR CARBON CEMENT
108" I.D. OF CUSTOMERS SHELL
28"
SECTION A-A
SPRAY OUTSIDE OF SHELL OR INSULATE INSIDE USING ONE COURSE OF INSULATING BRICK OR BLOCK
ACID OR BASIC BRICK
SECTION A-A
PATCH WHEN REQUIRED WITH CARBON PASTE

Diagram shows typical carbon-block well lining

Lining Cupolas with Carbon

By G. B. TATUM
National Carbon Co.
Division of Union Carbide & Carbon Corp.
Cleveland

THE primary function of cupola refractory materials is resistance to high temperature, but they also are called upon to resist one or more of the destructive influences of abrasion, pressure, chemical attack and rapid temperature changes. Quality and uniformity are necessary to protect the structural components of the furnace, to insure consistent working dimensions, and to assist a smooth stock descent with minimum contamination of the melt. Selection and installation of these refractories is, therefore, an important consideration.

Characteristics of Carbon—In many cases carbon (or graphite) is the only material which has met successfully the severe and exacting requirements involved in handling hot metals and corrosive slags. This success is due in large part to these facts:

1. Carbon is chemically neutral and is completely resistant to corrosion by slag. The high resistance of carbon linings to slag attack allows the cupola to be operated for extended periods without the need to drop the bottom for repair. Also, since neutral carbon linings may be used with either acid or basic slags, change from acid to basic operation may be made without relining.

2. Because carbon is not wetted by molten metals, metals do not stick to it. This characteristic saves maintenance time.

3. Carbon maintains its mechanical strength well past the temperatures attained in handling molten metals.

4. Carbon does not suffer deformation at elevated temperatures.

5. Carbon's resistance to thermal shock prevents spalling and consequent inclusions.

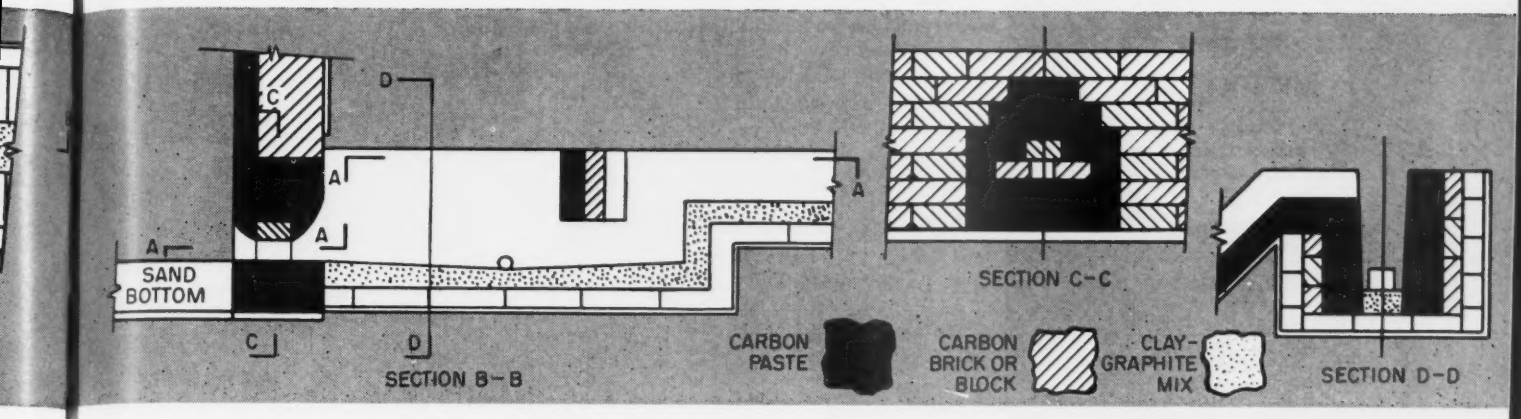
6. Since carbon well linings may be water quenched, repairs can be made in the cupola shortly after the bottom is dropped—an advantage when operations are at peak capacity.

The first installations of carbon linings were made by companies which were operating basic cupolas and had experienced high refractory costs due to the corrosive action of basic slag. The well zones were lined with carbon. The melting zone was left unlined, but external water cooling of the shell was employed at both the melting and well zones. Exceptionally good life was experienced with only routine maintenance.

Carbon Blocks, Brick or Paste?—Carbon brick or carbon blocks are superior to carbon paste because they are fabricated and molded under high pressure, which gives them a greater density than carbon paste. The more dense molded block or brick thus is less subject to slag corrosion than the more porous paste structure, and service life, therefore, is much longer. Large block is more efficient than brick because of the fewer number of cemented joints, where deterioration usually begins. In addition, less time is required to install large-block linings. Size of the carbon blocks depends upon the economics of cutting and design and the limitations of maximum weight of any one block. Some foundries are limited to the weight one man can handle, which has been arbitrarily set at 50 lb. In other foundries, facilities for handling permit the use of much larger blocks, up to about 400 lb.

Carbon blocks should be considered a safe and reliable primary refractory material, with carbon paste used as a patching material to maintain the original contour of the block lining necessary.

Some foundries have applied carbon paste to a lining of acid or basic refractory material, by building up a thickness of 5 or 6 in. It is handled much like any other plastic refractory patching material and results in a substantial reduction in refractory costs. Carbon paste adheres better to a carbon block base, however, and in consideration of the added safety factor afforded by the carbon blocks as a primary lining material, there is little justification for not



Illustrating the design of a carbon-lined, front-slagging cupola spout

using an entire lining of carbon.

The first cost of a well-zone lining is not significant in an evaluation of the actual cost of carbon lining. A block lining will last anywhere from six months to a year and a half or better, due in large part to the fact that fewer joints are exposed. Thus its cost, amortized over the full life of the lining, is insignificant when computed on the basis of refractory cost per ton of metal.

Well-Zone Lining—When carbon materials are considered for lining a cupola well, it should be noted that all three types of linings—that is, brick, blocks or paste—now are being used. Determination of the form in which carbon is used should be made largely on the basis of economics. The most efficient lining for the well zone has been found to be large blocks applied directly against the shell of the cupola, which should be water cooled by means of an exterior spray.

External water cooling is recommended wherever practical, although insulating materials between the shell and the carbon lining have been used successfully in the absence of cooling. One such construction uses an intermediate course of ceramic brick 4½-in. thick laid next to the shell to act as insulation between the carbon and the shell.

Some experiments are under way to establish the economics of carbon as a melting zone lining. Initial results have been favorable enough to encourage additional work.

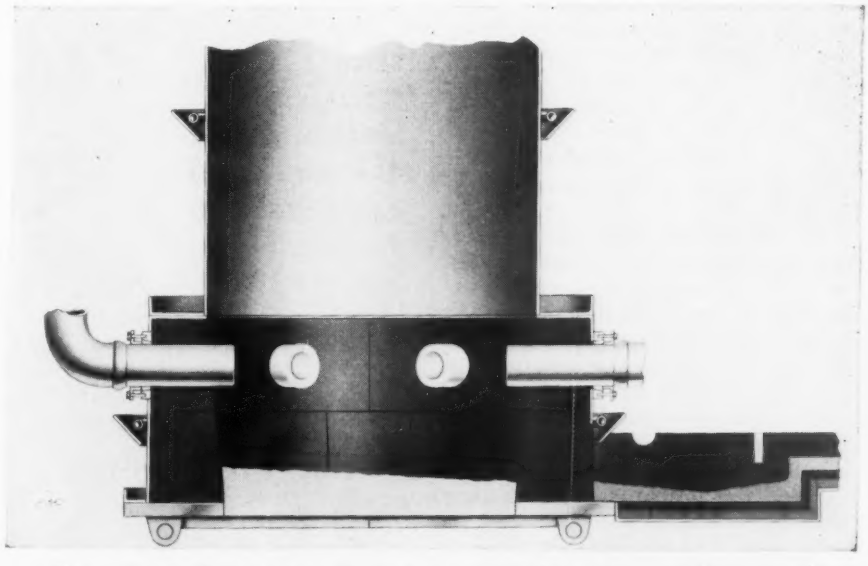
A trend in new cupola design is toward incorporating an unlined, water-cooled melting zone with a carbon-lined well. This construction permits the operator to use acid, basic or neutral slags without changing the lining because the carbon is chemically inert. Also, and of increasing importance, because of carbon's resistance to slag attack, this design allows the cupola to be operated for extended periods of time without dropping the bottom for repairs or relining. Operation without frequent repairs reduces maintenance expense, and at the same time considerable savings are made in material costs.

One foundry which was running iron of relatively fixed analysis, was very conscious of the variations in costs of raw materials used in the charge. With carbon linings, varying percentages of scrap or pig—depending upon the economics of the metal market—could be used in making up the charge. Because the make-up of the slag could be altered to compensate for variations in raw materials charged, analysis of the heat was maintained within close limits.

In another instance, a jobbing foundry was faced with the problem of excessively high operating costs created by the demand for tailor-made iron. The ability to change the slag without danger of harming carbon lining permits holding the analysis of the heat to close specifications. At the same time, sulphur content is controlled at a low level—a must in nodular iron production.

Again, a production foundry had the problem of producing close-analysis iron containing a minimum of sulphur. The problem was solved economically by variations in the slag composition in a carbon-lined cupola.

Slag Trough—Carbon first was put into the front-slagging trough lining because at this point the behavior of the refractory could be observed closely. Such wear as does occur in the trough is below the metal line and is due almost entirely to erosion. A course of basic or acid brick is laid against the outer shell of the trough box for insulating purposes. Inside it, a course of carbon brick is laid, with carbon paste rammed around a form constituting the replaceable working face. After initial installation, the paste is reapplied as patching becomes necessary. The heat required for baking-in is furnished



This cross-sectional view illustrates construction of a modern cupola built with an unlined, water-cooled shell and carbon-block well lining

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by the normal heat of operation. The use of carbon as a slag dam is also desirable. An example of its long life in such severe applications is demonstrated by the fact that carbon slag dam blocks have remained in service for as long as six months without replacement.

Breast and Tap-hole—There is no uniform design for breast and taphole construction. Among several satisfactory ways to apply carbon in this location are the following:

1. The taphole and breast may be made by using a steel form the size of the taphole and tamping carbon paste around it to fill the breast opening.

2. A carbon breast block machined to proper shape, with the taphole drilled.

3. Carbon brick may form the taphole, around which suitable ramming material is tamped to fill the breast opening. A small ceramic shape sometimes is used in the bottom portion of the hole.

4. A carbon breast block grooved to accommodate carbon and ceramic taphole bricks may be placed in the breast, with the breast opening closed with suitable ramming materials. This construction has proved most satisfactory.

Offers Operating Advantages

Operating Features: 1. The carbon well zone lining is protected by the pool of iron and slag and by the coke bed above it. 2. With a carbon lining it is possible to operate the cupola by banking between heats without dropping the bottom. 3. Because of the high thermal conductivity of carbon, the lining face can be water quenched after the bottom is dropped without danger of spalling. Immediate repairs thus can be made. 4. Extended foundry schedules do not harm the cupola operation. Moreover, many obvious benefits are gained by not dropping the bottom too frequently.

Carbon materials have been used in cupolas for a number of years, with no attempt to change operating practice. Since carbon resists abrasion, corrosion, chemical attack and rapid temperature changes, the practice of dropping the bottom for repairs of the well zone is not necessary, and the procedure should be given a modifying appraisal. Changes in traditional operating practice can be well justified by the experience with carbon-lined cupolas which have been operating for several years. It might also be pointed out that blast furnace hearth linings of carbon have operated continually for as long as ten years, producing well over 3 million tons of pig iron, without patching during that time.

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Foundry Statistics

MALLEABLE IRON

(Shipments of castings—net tons[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1953	970,506	578,749	.....
1954			
Sept.	58,015	33,929	66,742
9 mo.	607,066	334,412	.....
Oct.	64,321	36,956	71,090
Nov.	70,030	41,609	80,686
Dec.	80,599	49,005	85,064
Total	812,016	461,982	.....
1955			
Jan.	82,028	48,000	99,817
Feb.	85,979	48,721	101,766
Mar.	102,364	60,063	99,730
Apr.	101,226	57,397	104,091
May	98,397	57,317	106,446
June	99,456	60,261	107,559
July	75,570	44,914	115,420
Aug.	82,448	48,126	123,473
Sept.	87,215	55,471	116,636
9 mo.	814,683	480,270	.....

COPPER-BASE ALLOY

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—Sand	Shipments—Perm. Mold	Unfilled Orders[2]
1953	990,496	888,369	61,316	.....
1954				
Sept.	68,487	62,372	3,637	31,232
9 mo.	623,213	561,100	36,794	.....
Oct.	70,276	63,855	3,619	30,396
Nov.	70,020	63,065	4,089	27,608
Dec.	72,421	65,159	4,346	32,054
Total	835,930	753,179	48,848	.....
1955				
Jan.	72,233	64,540	4,678	30,864
Feb.	75,253	67,768	4,598	37,520
Mar.	92,149	83,149	5,649	42,940
Apr.	84,183	75,903	5,152	51,111
May	85,008	76,064	5,513	49,198
June	90,476	80,869	5,840	45,820
July	65,816	59,133	3,998	48,085
Aug.	87,206	77,721	5,322	51,251
Sept.	89,600	80,481	5,603	57,313
9 mo.	741,924	665,633	65,513	.....

ALUMINUM

(Shipments of castings—1000 pounds)

	Shipments—Total	Shipments—Sand	Shipments—Perm. Mold	Shipments—Die	Unfilled Orders[2]
1953	658,022	214,553	200,025	239,330	.....
1954					
Sept.	47,844	11,107	16,731	19,344	80,294
9 mo.	449,959	119,021	147,745	174,890	.....
Oct.	54,903	12,765	19,238	22,247	88,518
Nov.	56,066	12,934	20,396	22,137	94,491
Dec.	64,045	13,753	23,629	26,017	99,556
Total	624,973	158,473	214,408	245,291	.....
1955					
Jan.	64,414	13,358	23,679	26,819	102,382
Feb.	66,869	13,579	24,319	28,234	108,939
Mar.	78,958	16,019	29,029	33,229	110,046
Apr.	73,049	14,041	28,028	30,208	109,156
May	71,691	14,235	25,597	31,243	104,984
June	68,473	14,920	24,682	27,939	102,799
July	55,033	11,716	21,006	21,656	101,024
Aug.	64,864	14,916	22,267	27,004	105,994
Sept.	67,170	14,870	23,075	28,532	111,888
9 mo.	610,521	127,654	221,682	254,864	.....

MAGNESIUM

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1953	34,517	31,469	.....
1954			
Sept.	2,095	1,891	7,499
9 mo.	19,237	17,137	.....
Oct.	2,092	1,876	7,294
Nov.	2,161	1,906	6,867
Dec.	2,287	1,906	6,678
Total	25,777	22,950	.....
1955			
Jan.	2,305	2,067	7,236
Feb.	2,160	2,009	7,376
Mar.	2,572	2,311	7,011
Apr.	2,633	2,405	6,800
May	2,399	2,174	6,530
June	2,367	2,098	6,346
July	1,920	1,763	5,912
Aug.	2,176	2,002	5,964
Sept.	2,478	2,260	5,670
9 mo.	21,010	19,089	.....

PRODUCTION WORKERS

Estimated Number

(Thousands)

	Sept. 1955	Aug. 1955	Sept. 1954
Ferrous	219,000	214,200	178,600
Nonferrous	72,500	68,600	60,600

Average Weekly Earnings

Gray Iron	85.85	82.59	73.51
Malleable Iron	84.45	81.59	74.11
Steel	91.36	88.62	75.62
Nonferrous	87.77	84.03	79.80

Average Weekly Hours

Gray Iron	42.5	41.5	39.1
Malleable Iron	41.6	41.0	38.2
Steel	42.1	42.0	38.0
Nonferrous	41.4	40.4	39.7

Labor Turnover Rate (Sept.)

(Per 100 employees)

	Total Accession	Total Separation	Quit	Layoff
Gray Iron	5.0	4.2	2.6	0.9
Malleable Iron	5.2	4.1	3.0	0.2
Steel	5.0	4.0	2.5	0.6
Nonferrous	5.0	4.0	2.4	0.7

Source: Bureau of Labor Statistics

GRAY IRON CASTINGS—SHIPMENTS (Net Tons[1])

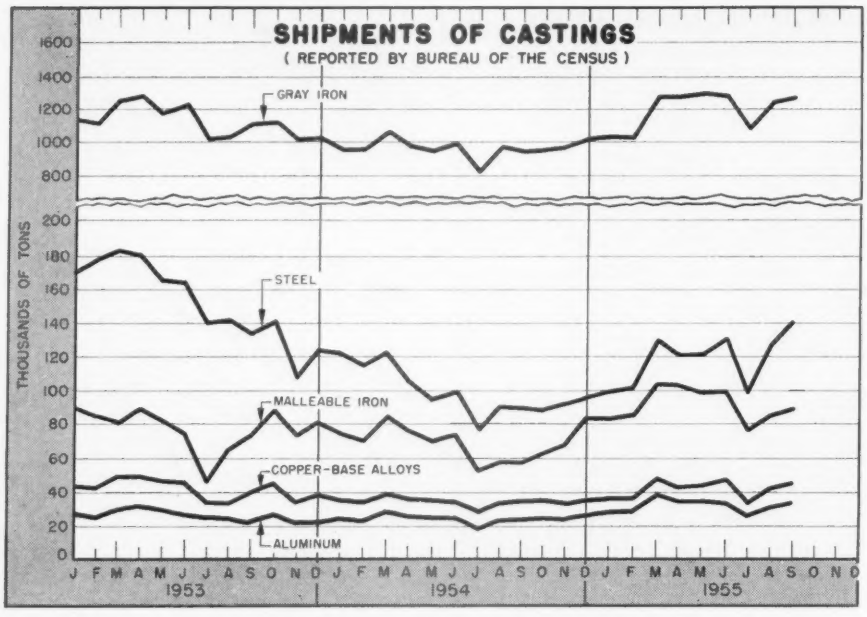
	All Castings—Total	All Castings—For Sale	Miscellaneous Castings—Total	Miscellaneous Castings—For Sale	Heavy Steel Ingot Molds—Total	Heavy Steel Ingot Molds—For Sale	Chilled Railroad Car Wheels—Total	Pressure Pipe & Fittings—Total[3]	Soil Pipe & Fittings—Total[3]	Unfilled Orders[2]
1953	13,707,902	7,494,843	8,449,837	3,675,454	2,829,159	1,389,483	467,142	1,285,598	677,166	.....
1954										
Sept.	921,232	533,909	559,934	248,124	139,679	68,053	25,374	124,821	71,424	810,654
9 mo.	8,517,662	4,659,821	5,417,837	2,276,106	1,266,316	581,069	259,308	1,016,783	594,431	.....
Oct.	942,934	552,022	570,365	253,802	150,282	79,191	23,599	130,326	68,362	789,117
Nov.	997,301	547,447	623,390	258,933	167,983	85,703	25,723	118,480	61,725	759,613
Dec.	1,074,258	563,699	680,700	276,045	200,004	97,936	27,229	111,082	55,203	744,633
Total	11,532,158	6,322,989	7,292,292	3,064,886	1,784,625	843,899	325,859	1,376,671	743,721	.....
1955										
Jan.	1,091,923	563,153	712,097	282,386	192,132	97,007	25,783	100,638	61,273	782,656
Feb.	1,106,165	578,171	720,304	291,675	196,118	99,794	27,401	95,285	67,057	852,168
Mar.	1,314,918	688,733	847,874	334,287	217,571	109,681	36,732	129,746	82,995	934,224
Apr.	1,293,678	679,867	819,872	319,149	216,116	108,490	35,415	145,871	76,404	966,057
May	1,310,424	707,105	803,897	315,072	227,236	117,915	35,966	168,772	74,553	937,949
June	1,296,196	715,862	793,067	327,520	228,044	117,727	43,807	147,351	83,927	981,918
July	1,069,711	579,122	634,869	246,297	210,130	112,137	28,181	129,191	67,340	1,049,565
Aug.	1,226,312	688,317	718,423	301,502	238,007	121,071	29,298	156,074	84,510	1,160,466
Sept.	1,252,736	712,688	731,073	314,223	244,199	124,811	29,953	165,332	82,179	1,150,933
9 mo.	10,962,063	5,913,018	6,781,476	2,732,111	1,969,553	1,008,633	292,536	1,238,260	680,281	.....

STEEL CASTINGS—SHIPMENTS (Net Tons[1])

	All Castings—Total	All Castings—For Sale	All Castings—Railway Specialties	Carbon—Total	Carbon—For Sale	Carbon—Railway Specialties	Alloy—Total	Alloy—For Sale	Alloy—Railway Specialties	Unfilled Orders[2]
1953	1,834,197	1,400,013	321,010	1,276,729	959,493	293,491	557,468	417,148	27,519	.....
1954										
Sept.	88,359	64,722	8,668	59,039	41,735	7,690	29,320	22,987	978	158,823
9 mo.	915,805	681,499	107,270	627,092	454,885	95,620	288,723	227,358	11,968	.....
Oct.	87,085	64,004	8,580	56,705	39,872	7,596	30,380	24,132	984	154,079
Nov.	87,659	64,812	7,742	56,057	40,085	6,624	31,602	24,727	1,118	175,715
Dec.	93,547	69,843	12,489	62,967	45,632	10,469	30,841	24,211	1,245	179,148
Total	1,184,096	880,158	135,581	802,321	580,474	120,309	381,285	303,428	15,315	.....
1955										
Jan.	98,238	75,044	13,809	67,307	49,816	12,762	30,841	25,228	1,047	201,839
Feb.	106,430	80,729	16,501	74,709	55,014	15,381	38,945	25,715	1,120	202,301
Mar.	127,460	98,926	19,339	88,867	68,013	17,887	34,933	30,913	1,452	215,059
Apr.	120,053	92,237	16,646	84,247	63,244	15,163	35,806	28,993	1,483	221,336
May	122,465	92,713	16,810	85,950	63,182	15,335	36,515	29,531	1,475	225,302
June	133,887	102,457	19,591	93,417	69,986	17,979	40,470	32,471	1,612	251,416
July	97,875	71,170	11,631	68,094	48,140	10,666	29,781	23,030	965	354,628
Aug.	126,406	96,290	20,576	91,245	68,514	19,094	35,161	27,776	1,482	413,531
Sept.	140,843	107,622	23,594	100,775	76,156	21,991	40,068	31,466	1,603	420,616
9 mo.	1,073,657	817,188	158,497	754,611	562,065	146,258	322,520	255,123	12,239	.....

[1]Source: Bureau of Census. [2]For sale only. [3]All cast iron pipe is shipped for sale.

FOUNDRY STATISTICS



COMMERCIAL HEAT TREATING

(National Billings of Metal Institute Members)

	1953		1954		1955	
	No. Reporting	Total Reported	No. Reporting	Total Reported	No. Reporting	Total Reported
July	58	$2,522,651	61	$1,722,499	63	$2,035,100
Aug.	60	2,452,186	62	1,801,659	64	2,439,300
Sept.	57	2,522,127	63	1,853,665	63	2,581,000
Oct.	59	2,782,219	63	1,891,100	63	2,785,100
10 mo.		27,047,164		20,600,400		24,005,400
Annual total		31,733,067		24,244,368		21,219,880

COKE PRODUCTION AND CONSUMPTION

(Net tons)

	Production	Consumption Total	Consumption By Foundries
1953	78,467,806	78,227,414	2,915,420
1954			
Sept.	4,490,603	4,434,000	191,607
9 mo.	43,603,548	43,139,880	1,833,013
Oct.	5,082,374	5,100,135	208,418
Nov.	5,230,237	5,283,916	221,391
Dec.	5,610,564	5,615,228	217,104
Total	59,526,723	59,139,159	2,479,926
1955			
Jan.	5,805,926	5,862,113	234,784
Feb.	5,394,166	5,519,241	242,282
Mar.	6,235,909	6,306,723	286,072
Apr.	6,135,645	6,164,459	278,242
May	6,426,747	6,570,567	277,967
June	6,148,026	6,297,338	249,525
July	6,169,770	6,266,631	221,372
Aug.	6,395,422	6,439,101	249,425
Sept.	6,393,348	6,489,083	259,479
9 mo.	55,104,959	55,915,256	2,299,148

INGOT BRASS AND BRONZE

(Shipments in net tons)

	1954	1955
Jan.	20,661	25,201
Feb.	19,920	25,349
Mar.	23,653	29,713
Apr.	24,746	27,641
May	22,269	23,708
June	22,348	23,141
July	17,074	18,513
Aug.	21,684	27,013
Sept.	22,464	26,349
Oct.	24,080	25,228
Nov.	23,061	.....
Dec.	21,273	.....
Total for year	263,233	.....

ZINC-BASE ALLOY

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1953	521,253	349,022	.....
1954			
Sept.	38,973	25,617	56,206
9 mo.	371,899	225,090	.....
Oct.	42,202	27,337	64,700
Nov.	51,990	35,207	62,950
Dec.	54,410	35,211	69,603
Total	520,501	322,845	.....
1955			
Jan.	58,586	35,472	70,691
Feb.	58,585	35,893	73,858
Mar.	71,811	44,048	81,363
Apr.	71,595	45,477	81,756
May	63,735	38,124	74,472
June	66,569	42,753	71,344
July	47,928	27,429	68,927
Aug.	62,677	61,957	75,592
Sept.	62,030	43,498	80,660
9 mo.	563,516	374,651	.....

INDEX OF FOUNDRY EQUIP. ORDERS

Foundry Trades Only

(Net Orders Closed, New Equipment)

	1954	1955
Jan.	173.8	81.0
Feb.	99.9	90.4
Mar.	82.7	163.6
Apr.	125.3	178.6
May	80.8	145.7
June	86.4	186.8
July	68.8	213.4
Aug.	75.6	134.0
Sept.	68.3	156.7
Oct.	147.5	....
Nov.	61.4	....
Dec.	113.9	....

Note: Figures are percentages of the base period 1947-49 taken as 100 per cent (monthly average). This is a new base period. Source: Foundry Equipment Manufacturers Association.

IRON AND STEEL SCRAP CONSUMPTION

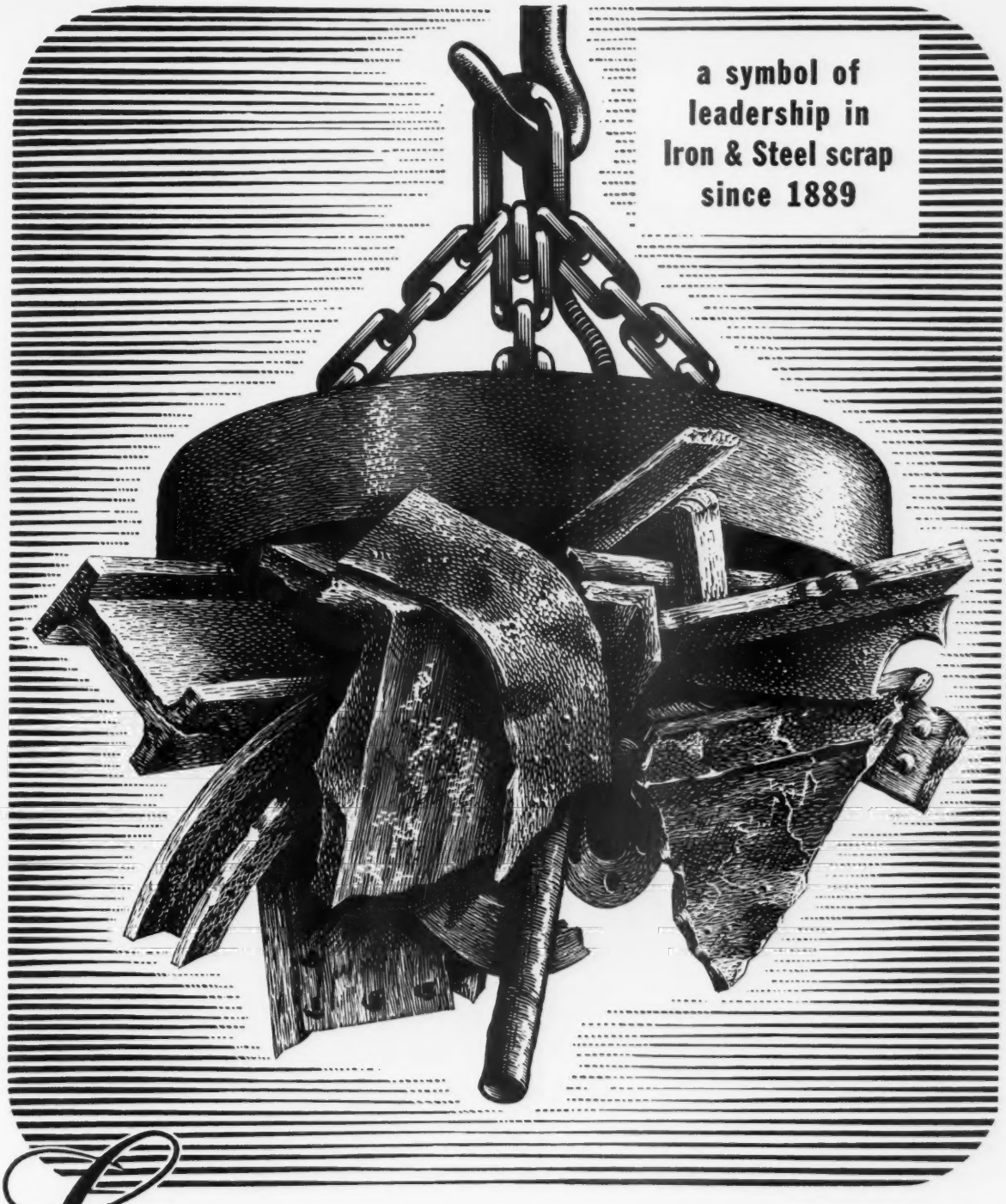
(Gross tons*)

	All Scrap Total	By Types of Furnace—Cupola Total	By Types of Furnace—Air Total	By Types of Furnace—Electric Total
1953	69,005,976	9,676,463	1,026,334	8,263,880
1954				
Aug.	4,164,703	671,631	65,336	486,596
8 mo.	35,695,362	5,621,140	553,915	3,932,142
Sept.	4,298,495	675,593	68,860	500,349
Oct.	4,782,488	710,127	67,678	528,432
Nov.	4,928,850	737,286	71,844	573,298
Dec.	5,075,563	798,435	82,910	566,223
Total	54,780,758	8,542,581	855,207	6,100,444
1955				
Jan.	5,416,052	813,682	90,622	614,824
Feb.	5,350,452	823,465	91,916	577,296
Mar.	6,313,717	993,266	113,198	727,401
Apr.	6,239,036	975,751	108,965	726,138
May	6,415,947	963,082	109,074	745,060
June	6,117,573	928,908	116,419	733,573
July	5,447,130	730,735	81,216	623,623
Aug.	5,913,031	868,644	101,607	765,343
8 mo.	47,212,938	7,097,533	813,017	5,513,258

PIG IRON PRODUCTION AND CONSUMPTION

	Production** (standard grades—net tons) Total	Foundry	Malleable	Basic	Low Phos. Intermediate Low Phos. & Bessemer	Consumption* (By type of furnace—gross tons) Total	Cupola	Air	Electric
1953	74,879,511	2,599,307	3,736,431	60,465,016	8,347,825	66,637,364	4,918,480	272,311	164,267
1954									
Oct.	4,937,436	212,237	248,643	3,979,437	497,119	4,518,770	367,063	16,186	11,307
10 mo.	47,382,758	1,808,895	2,275,739	38,741,022	4,557,102	42,631,126	3,585,166	179,151	125,409
Nov.	5,204,446	202,824	263,484	4,233,253	504,885	4,764,215	375,526	16,178	15,932
Dec.	5,526,720	229,717	259,423	4,510,772	526,808	4,978,200	403,726	19,829	13,917
Total	58,113,924	2,241,436	2,798,646	47,485,047	5,587,465	52,373,541	4,364,418	215,158	155,258
1955									
Jan.	5,729,404	243,608	272,451	4,703,875	509,470	5,202,360	409,281	18,874	20,016
Feb.	5,394,585	209,852	252,860	4,425,080	506,793	4,964,515	409,141	20,576	22,551
Mar.	6,406,902	221,437	359,413	5,239,116	586,936	5,830,943	480,639	24,066	15,931
Apr.	6,329,927	210,085	305,188	5,068,506	746,148	5,725,258	467,709	21,536	12,857
May	6,753,236	246,661	342,544	5,385,299	788,732	6,044,882	471,657	21,448	20,085
June	6,494,838	238,412	347,631	5,245,861	662,934	5,774,896	454,751	22,871	21,697
July	6,329,393	233,235	344,365	5,116,960	634,833	5,430,550	361,171	16,483	19,535
Aug.	6,529,580	251,459	319,951	5,214,901	743,269	5,769,689	442,532	22,014	25,685
Sept.	6,653,578	252,630	343,919	5,397,134	659,895	.....	.....	.....	.....
Oct.	6,905,280	267,405	315,045	5,647,527	675,303	.....	.....	.....	.....
10 mo.	63,526,723	2,374,784	3,203,367	51,444,259	6,504,313	.....	.....	.....	.....

*Source: U. S. Dept. of Interior. Bureau of Mines. **Source: American Iron & Steel Institute. [1]Source: Bureau of the Census. [2]For sale only.



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SYRACUSE CONFERENCE

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By JACK C. MISKE
Associate Editor

IN SPITE of the simultaneous arrival of the first snow and cold of the winter, over 175 foundrymen gathered Nov. 18-19 for the New York-Canada-Pennsylvania Regional Foundry Conference at Hotel Onondaga, Syracuse, N. Y. They heard a wide variety of technical papers covering many aspects of foundry practice.

Participating AFS chapters were Eastern New York, Rochester, Western New York, Northwestern Pennsylvania, Ontario and Eastern Canada. Central New York Chapter was host. Edgar G. White, Crouse-Hinds Co., Syracuse, was general conference chairman, and vice chairman was Lloyd S. Wright, U. S. Radiator Co., Geneva, N. Y.

A general session opened the conference Friday morning. After the welcoming address by Chairman White, the first paper of the meeting was delivered by John Gotheridge, Foundry Services Inc., Columbus, O., discussing **The Carbon Dioxide Process—Its Uses in the Foundry.**

Mr. Gotheridge described what is necessary to assure successful application of the process. A clean, dry, clay-free, cold silica sand should be used, without fines or other extraneous matter. Proper binder content will vary with sand fineness. Mulling should be held to a minimum since too much promotes stickiness. Sand should be rammed at sharp edges. Undergassing is preferable to overgassing. Compression strength is 200-300 psi immediately after gassing and rises to about twice the original value in 24 hours. It continues to rise indefinitely, but at a much slower rate. Where difficulty with collapsibility occurs, additions of up to 2 per cent of powdered pitch give good results. Mr. Gotheridge's paper will be presented in an early issue of FOUNDRY.

Three papers were presented at a panel session on Friday afternoon. First speaker was Kenneth Digney, Oberdorfer Foundries Inc., Syracuse, who discussed **Pattern Requirements for Production Foundries.** Mr. Digney pointed out that World War II created a new concept of the foundry industry. Demands for greater strength, accuracy and complexity of design in castings were reflected in requirements for patterns.

In the usually accepted order of productivity, production pattern equipment includes loose patterns, matchplates and cope and drag patterns. Loose patterns ordinarily are not considered production equipment, but requirements of size, complexity and life expectancy can require their use. Size is the controlling factor and creates the problem of shrink. The matchplate is the lowest cost equipment capable of extremely high production per man-hour. It lends itself to castings of small size and comparatively simple design. Life expectancy is low, but so is replacement cost. The ultimate for common patterns is the cope and drag pattern, which is used on all types of molding machines.

Second pattern speaker was Guy A. Pealer, Elmira Foundry Division, General Electric Co., Elmira, N. Y., whose subject was **Co-ordinating Design and Use of Patterns.** One piece of pattern equipment, he stated, cannot be used properly by all types of foundries. It must be fit for a given foundry's equipment and production methods. The price of a pattern is not an adequate basis for having it made; more expensive patterns are ultimately the cheapest if they permit sufficiently lower unit cost of castings. A pattern buyer should know what he needs and should specify it, without compromise.

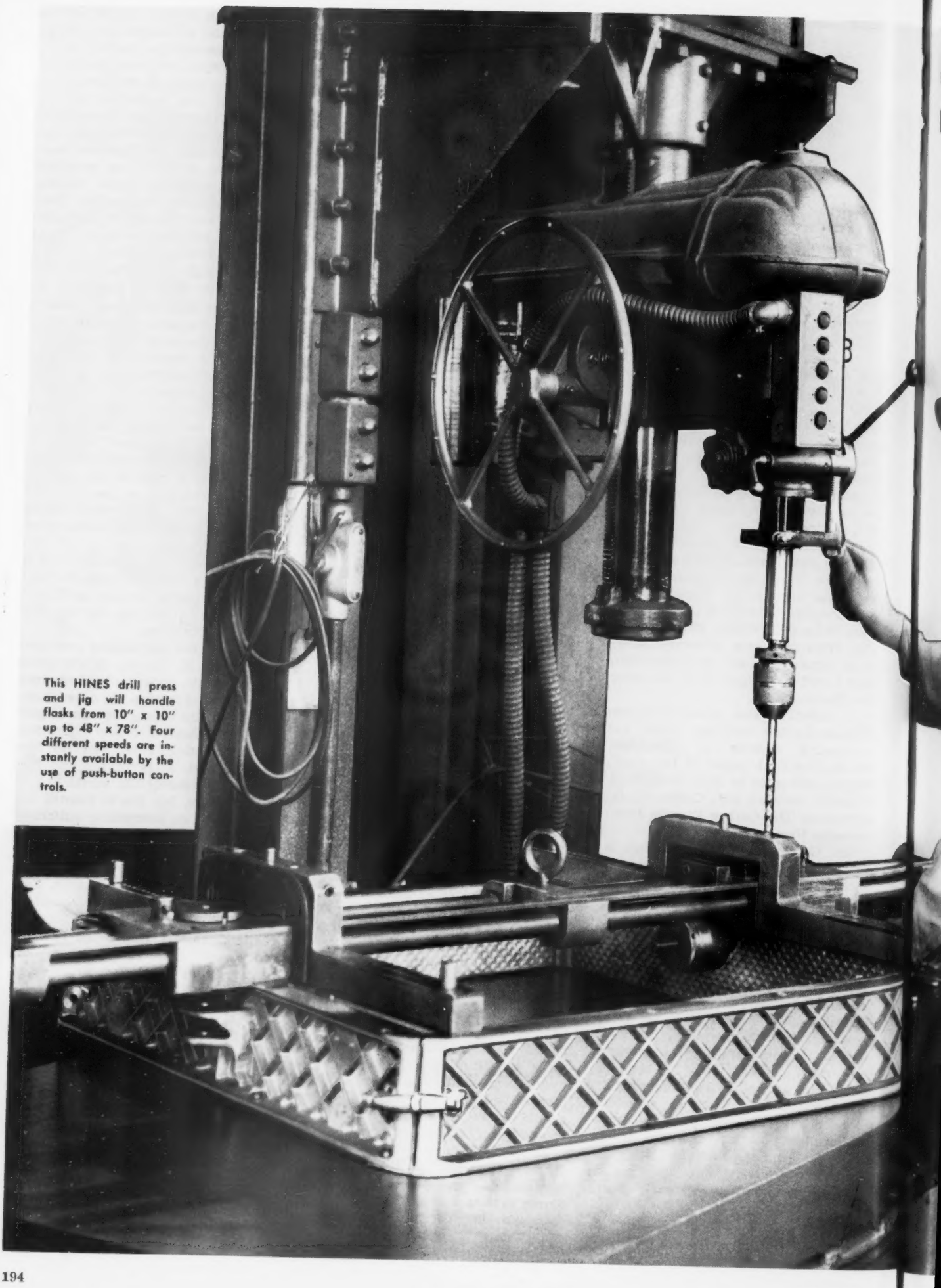
Louis V. Burns, Carrier Corp., Syracuse, presented the final pattern paper, **Purchasing Patterns.** Mr. Burns acts as a co-ordinator between Carrier's engineering department, the foundry and the pattern shop. Drawings of all new castings are submitted to him to write up pattern descriptions and to suggest any design changes necessary for practical molding. This system combines the knowledge and efforts of patternmaker, foundryman and customer. As far as possible, patterns are constructed so that they cannot be held even partially responsible for defective castings. Before patterns are specified, Mr. Burns considers these factors: Number of pieces required per year, use of the castings and relative importance of machined surfaces. These points are vital to pouring positioning and the type of molding required.

Charles F. Walton, technical director, Gray Iron Founders' Society, Cleveland, discussed **Risering Gray Iron.** This discussion was based substantially on material in Mr. Walton's article "The Principles of Risering," which appeared in the February, 1953, issue of FOUNDRY. Risers are applied to castings for five reasons: To vent the mold cavity, to avoid the hydraulic ram effect, to indicate when a mold is full, to flow off cold metal and to absorb liquid contraction. To absorb solidification contraction of a casting, a riser must be applied to the casting at the point or points which solidify last; it must stay liquid longer than the casting, and it must contain sufficient liquid metal to feed the casting during its solidification.

At the second and closing gray iron session, T. H. Burke, Worthington Corp., Buffalo, spoke on **Modern Gray Iron Cupola Practice.** He covered exhaustively the many factors important to successful cupola operation, including lining, coke, bed, air, tuyeres, fluxes, slagging off and ferroalloys. Stressing the variability of these factors, Mr. Burke pointed out the need to do everything uniformly in a given cupola operation, without inconsistencies.

At the first nonferrous session, R. A. Colton and D. L. Lavelle, Federated Metals Division, American Smelting and Refining Co., Newark, N. J., discussed **Gating and Risering Brass and Aluminum Alloys.** They stressed that the foremost causes of defective aluminum and copper alloy castings are poor pouring, gating and risering practices. In brass castings, defects are due primarily to gating. The system should be designed to minimize turbulence and agitation. Proper gating is especially important for high-shrinkage, high-dross alloys such as aluminum and manganese bronze.

Discussing aluminum, they advised that aluminum is more sensitive to improper gating than brass since shrinkage is caused readily by hot spots which result from poor distribution of liquid metal into the



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mold. Multiple ingates can help to overcome this problem. Use of a drag runner and cope ingate system has proved very beneficial in controlling metal flow into the mold. Chills, insulated risers and hot-topping of risers also are recommended.

William A. Mader, Oberdorfer Foundries Inc., addressed the final nonferrous session on **Application of Insulated Risers to the Production of Aluminum Alloy Castings.** Mr. Mader pointed out the function of risers in controlling directional solidification and thereby eliminating shrinkage porosity. Increased efficiency of risers is vital since shrinkage porosity seldom is eliminated with conventional risers, even though aluminum casting yield averages only about 40 per cent. Methods of increasing such efficiency include proper location and dimensioning of risers and the use of insulating sleeves. The latter surround the riser and cover it to reduce heat losses, keeping the metal liquid longer and permitting use of smaller risers.

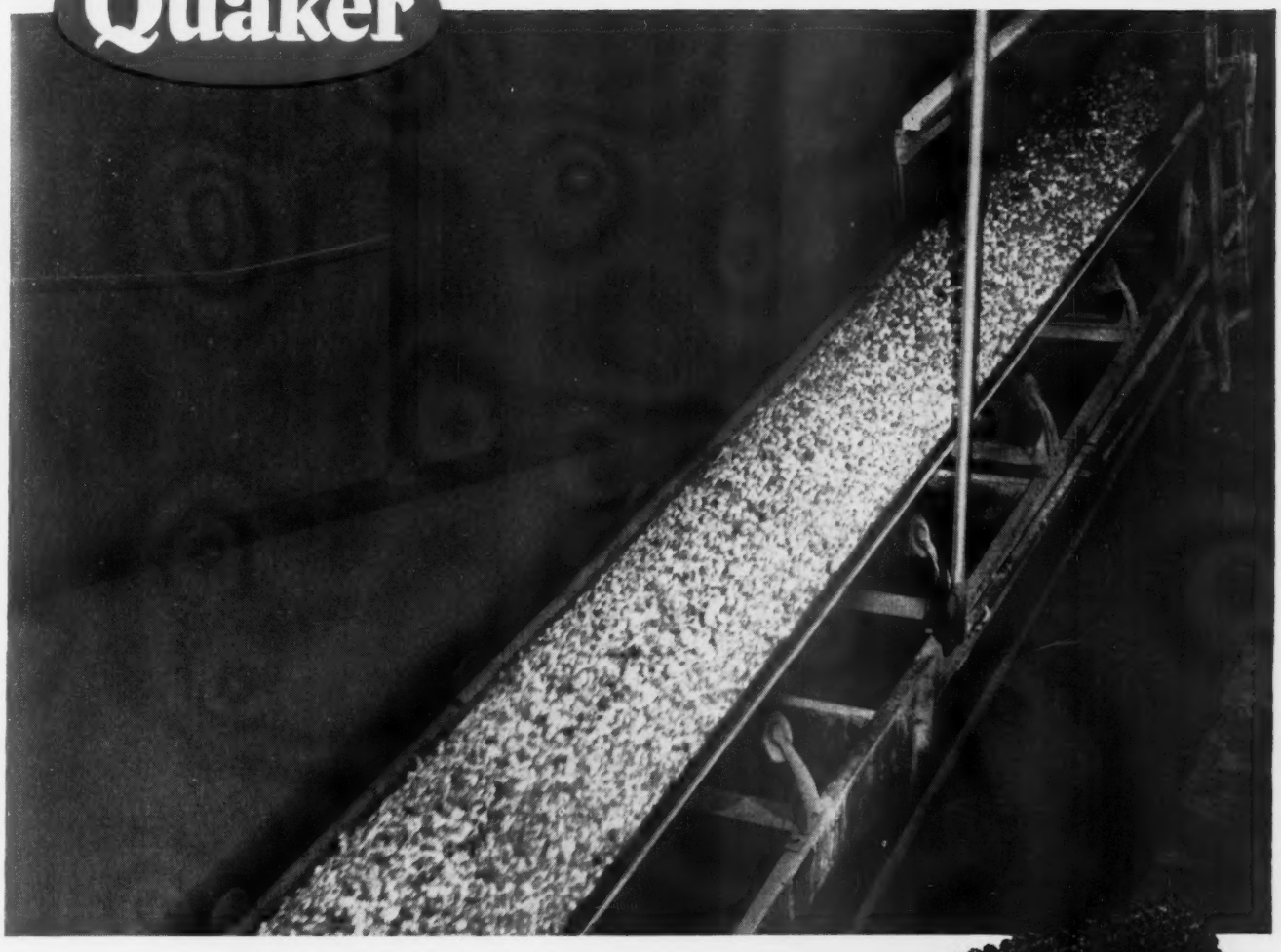
Such sleeves can be made of permeable gypsum plaster, perlite or exothermic material. Perlite sleeves, Mr. Mader stated, are not quite as efficient as gypsum sleeves, but are cheaper and can be produced faster. Exothermic sleeves are considerably more expensive than those of gypsum and perlite, but the higher cost is balanced to some extent by higher thermal efficiency, which permits use of a smaller sleeve and increases casting yield. Use of sleeves should be complemented by intelligent chilling.

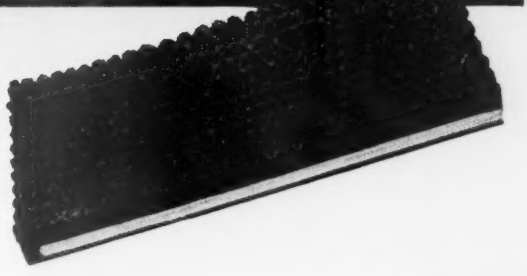
At the first of two sand sessions, C. E. Wenninger, National Engineering Co., Chicago, discussed **Digging Into Sand Fundamentals.** Mr. Wenninger said that foundrymen must consider the physical relationships of sand components and discount some set thoughts on test properties. Tests are for control after it has been decided that a given sand will work. A four-sieve sand with rounded grains ordinarily is preferable because it will ram compactly, but what is good for some jobs might not work as well for another job or another foundry. There is no standard sand.

In synthetic sand, it might be well to add more than enough clay and fines and mull the mixture less. The sand thereby can hold more water. Such procedure is a trend to what natural sands are like. Some sands must be mulled, and some can be mixed. When clay is added to low-clay sand, mulling is required. Adding water too fast creates clay balls. A lubricant such as core oil can be added to facing sand to give flowability.

At a session on casting quality, the

Quaker





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Are your hot-materials handling jobs taking an unnecessarily heavy toll in belt costs? They needn't—if you use conveyor belts specially engineered for your specific job conditions. Here's a case that gives real weight to that argument. For 11 months this belt hauled 850,000 tons without requiring replacement—more than double the life of belts previously used on this job. It is one of several types engineered by Quaker-Quaker Pioneer for jobs involving temperatures over 400°F. Some, like this one, are rough top construction enabling the belt to react rapidly to cooling methods. Others are of newly developed compounds, exceptionally heat-resistant to prevent hardening and cracking. Get the cost-saving benefit of this specialization by telling us—or your distributor—*your* problems. Our complete line contains everything you need in industrial rubber products, including hose, packing and moulded rubber for every use.

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speaker was B. C. Yearley, National Malleable & Steel Castings Co., Cleveland, whose subject was **Casting Defects.** Mr. Yearley emphasized that mechanization and job specialization have eliminated much of the individual production employee's responsibility for scrap. Casting designers, foundry engineers, line foremen and other supervisory personnel must assume that responsibility. When each production employee does just one job and probably knows little about the next man's, his personal control over quality dwindles. His supervisor should have a grasp of the entire production process and check that each step is made properly. The molder cannot control the sand he uses, nor check on cores, for example, just as pouring crews cannot be responsible for bad metal. Supervision must provide quality control.

The second sand session heard a discussion of **Elevated Temperature Properties of Molding Sands** by Victor Rowell, Harry W. Dietert Co., Detroit. Mr. Rowell pointed out that although sand must have certain room-temperature properties, elevated temperature properties are important because the sand is hot when it is doing its intended work—shaping metal into its final form. Key elevated temperature properties are strength, stability and collapsibility. Silica sand grains expand upon heating, with rather violent expansion occurring at a little under 1200° F. This expansion cannot be prevented, but it must be controlled.

Sands bonded with fire clay or western bentonite should be worked on the dry side. Sand bonded with southern bentonite should be overtempered. Veining can be prevented by reducing organic binders, by using iron oxide for iron castings and bentonite and silica flour for steel and by using sand with a lower sintering point. Penetration caused by oxidation can be inhibited by seacoal in sand for iron castings and by a good wash or by the fusion of bentonite and silica in sand for steel castings. Any material added to sand has some influence on elevated temperature properties.

At the conference's single malleable iron session, Gordon B. Mannweiler, Eastern Malleable Iron Co., Naugatuck, Conn., spoke on **Production of Pearlitic Malleable Iron.** Reviewing the basic methods currently used for commercial production of pearlitic malleable, Mr. Mannweiler particularly dwelt on the use of manganese ladle additions.

When the latter are used, manganese content of the base iron must fall within reasonable limits, the computed amount of alloy must be accurately weighed, packaged and added

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to the iron, and the weight of iron to be treated by a given amount of alloy should be controlled so as to produce the desired pickup. Manganese alloying offers these advantages: 1. Castings can be processed in standard malleable cycles, although better properties are obtained from a quench and temper treatment. 2. Work hardens to a greater depth on air quenching than does unalloyed iron. 3. Greater latitude is permissible during the subcritical cycle. Response to treatment is slower and more uniform, and properties are uniform. 4. Pearlite distribution after air quenching is finer than in unalloyed iron. 5. The final product is stabilized against exposures to elevated temperatures, up to 1200° F. 6. Response to hardening is faster than in unalloyed, but otherwise similarly processed, air-quenched irons.

Disadvantages include blowholes or pinholes, mottling tendencies, cost of alloys, cost of packaging and handling ladle additions and the additional supervision required during pouring.

Mr. Mannweiler also described the mechanical processes required to produce pearlitic and compared the relative merits of various procedures, such as air versus liquid quenching. He further noted that pearlitic can be manufactured by the conversion of a fully malleablized material through reheating, quenching and tempering.

A separate nonferrous session featured the first and second prize winners in a technical paper contest held by Ontario Chapter of the AFS. Winner of first prize was John R. Morgan, Foundry Services (Canada) Ltd., Guelph, Ont., with a paper on **The Cause and Prevention of Gas Porosity and Nonmetallic Inclusions in Aluminum Alloys.**

Gas porosity results chiefly from hydrogen, which forms cavities in the metal when it is expelled during solidification of the aluminum. Although hydrogen absorption can be held down, a degassing process often is essential. Chlorine and nitrogen gas bubbled through the melt remove much gas, but are less efficient as gas content lowers. Chlorine also fluxes films of aluminum oxide which otherwise hinder the escape of hydrogen. Hexachloroethane, a fully chlorinated hydrocarbon, can be applied conveniently in the form of a tablet which is plunged to the bottom of the melt. At high temperatures, it decomposes to yield chlorine and other volatile chlorides which bubble through the metal as scavenging gases.

Because the chlorine is released in the nascent (atomic) form, the toxic fumes which accompany the use of pure chlorine gas, which is molecu-

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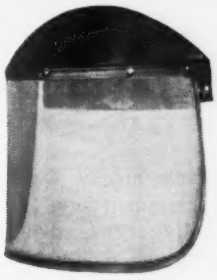

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Die Cast Engine Block

Weighs 43 pounds . . . .

Six cylinder aluminum engine blocks moving on conveyor line from 250-ton die casting machine in background. Machine can make 30-35 blocks per hr

ALUMINUM engine blocks weighing 43 lb when trimmed have been die cast successfully. The straight type, six-cylinder blocks weigh 50 lb as cast and represent the largest die castings ever made in aluminum. A similar gray iron block would weigh 175 lb.

The blocks have been produced from an experimental die on the world's largest die casting machine located at Doehler-Jarvis Division, National Lead Co., Toledo, O. Machine weighs 250 tons and can handle dies weighing up to 50 tons. These two developments—the machine and the blocks—have resulted from a joint project of National Lead and the Kaiser Aluminum & Chemical Corp.

Blocks can be produced at a rate of 30-35 per hr on a single machine. About 1700 lb of molten aluminum per hr is required to meet this production demand.

Machining of the die cast blocks is confined to the main sealing areas. All 129 holes in the block are cored and cast to size with no additional drilling required. Relatively high heat conductivity of aluminum helps to simplify the block's cooling system. Additionally, the smooth die cast surfaces promotes the flow of cooling water.

While the six-cylinder blocks are undergoing intensive testing, Doehler-Jarvis engineers are developing a V-8 aluminum block that is expected to weigh 70-75 lb.

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lar, do not occur. Nitrogen has the disadvantages of not being as efficient and of requiring drying apparatus. Mr. Morgan also discussed the use of various fluxes for grain refinement, control of oxidation, control of alloy structure and purity and other purposes.

Alan R. Moore of Ontario won second prize with his paper on **Gating and Risering of Nonferrous Alloys.** Mr. Moore's paper was read by W. H. L. Bryce, International Harvester Co. of Canada Ltd., Hamilton, Ont. Mr. Moore stated that the problem of blows in the mold cavity usually is attacked through the core, but could be cured 90 per cent of the time by proper ingating. In addition, metal must be poured properly. All factors must be constant, and pouring is the most variable. It should be as fast as possible and the sprue kept full. It is best to keep the ingates as small as possible. Aluminum should be gated to the thinnest sections and, generally, should be chilled, not fed. Runners and gates should be decided on before the pattern is laid out. It is a poor practice to put more than one casting with different gating on the same plate. Putting fewer castings on a plate may increase yield and afford ultimate economy.

The conference banquet was held Friday night, and the large audience was entertained by a talk on **Life in Foreign Lands** delivered by Leonard Greenfield, Samuel Greenfield Co., Buffalo. Bruce Simpson, National Engineering Co., Chicago, president of the AFS, complimented the sponsors for a fine meeting, and W. W. Maloney, general manager of the AFS, spoke briefly about the 1956 AFS national convention in Atlantic City, N. J., May 3-9.

Final session of the meeting was a luncheon Saturday noon at which the AFS research film, "Study of Fluid Flow of Light Alloys Through Vertical Gating Systems," was shown to the audience.

Steel Founders Issue Directory

The 1955 biennial directory of the Steel Founders' Society of America now is available for public distribution. It includes every known steel foundry in the United States, Canada and Mexico and gives basic information as to type, size and kind of steel castings they produce. The volume also lists melting, heat treating and special processes used, as well as rated capacity, number of employees and names of key personnel.

Copies are available at $10 each from the society, 606 Terminal Tower, Cleveland 13.

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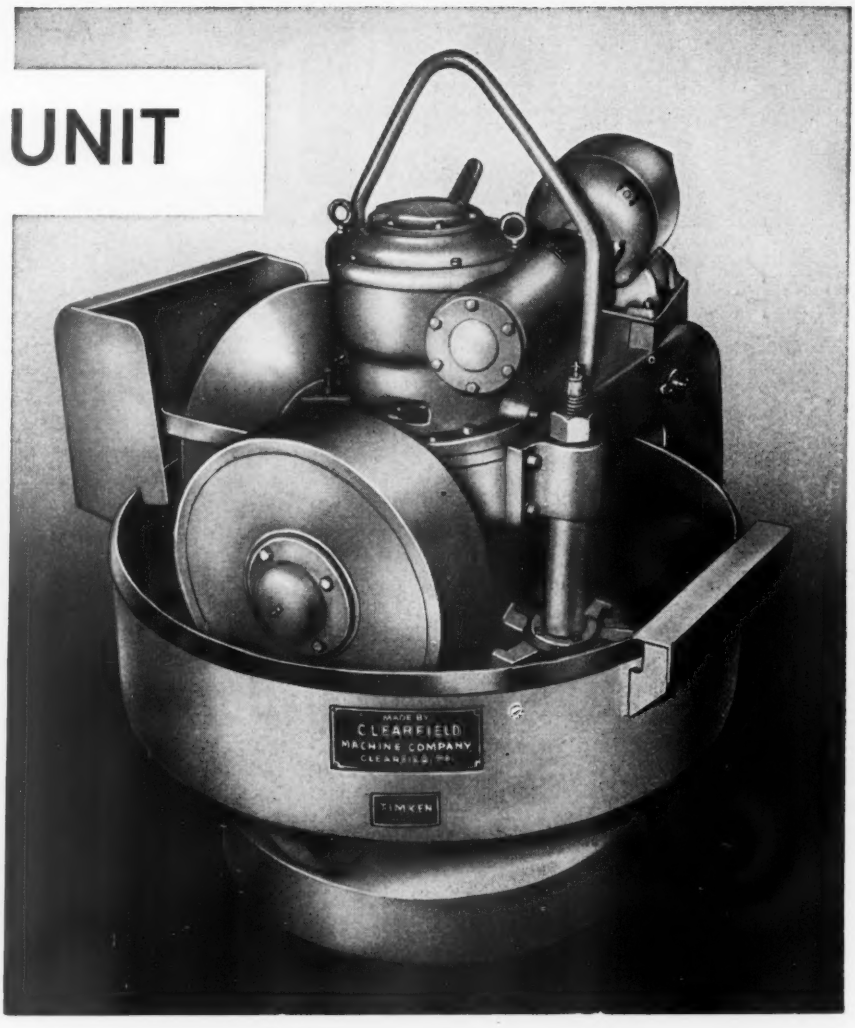
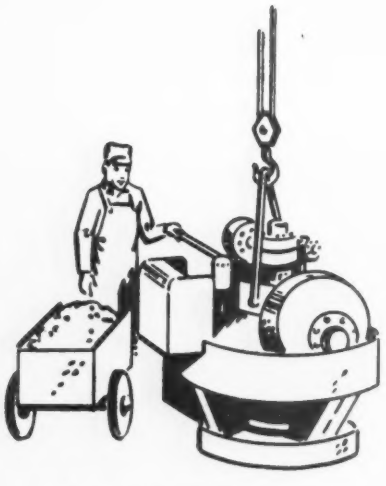
the CLEARFIELD No. 414





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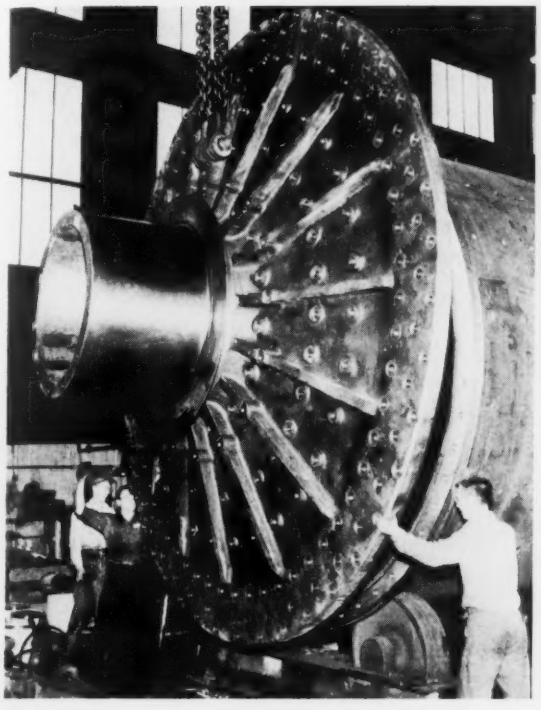
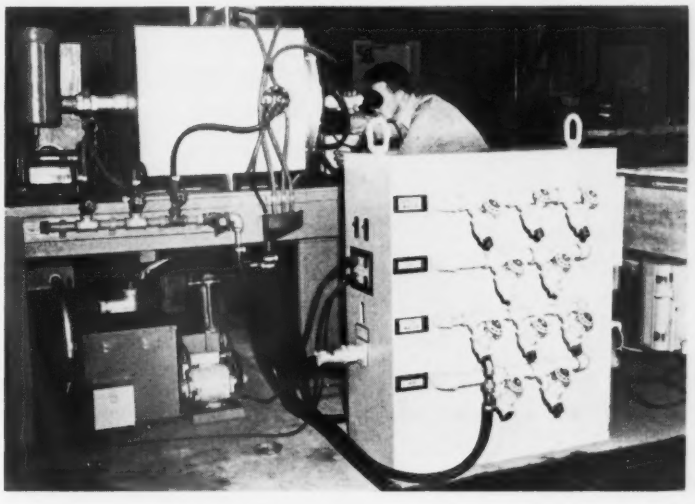
News Views

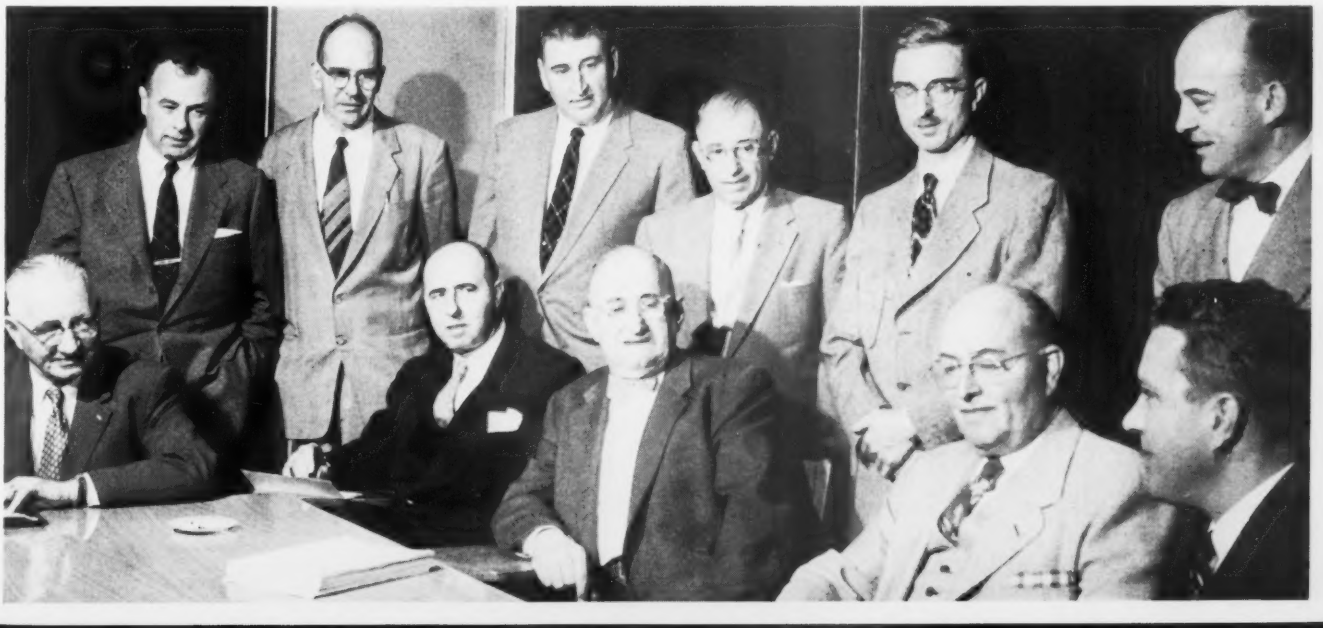


HEAVY HEAD: Heads and trunnions of 11½-ft-diameter grinding mill are 40,000-lb steel castings poured at Standard Steel Works Division of Baldwin-Lima-Hamilton Corp., Burnham, Pa. Castings carry load including rotating mill, grinding balls, and charge material, including its impact load

SERVICE REWARD: At the recent fifth annual banquet of the Quarter Century Club of the Pangborn Corp., Hagerstown, Md., seven new members were welcomed and given inscribed gold watches. Left to right, front row, are new members J. L. Keeney, M. F. Poe, G. M. Elliott, J. S. Grove, W. A. Byers, E. C. Gilmour and L. Hasenbuhler



UTILITY ISLANDS: To provide flexibility in recently completed chemical engineering building at Niagara Falls, Electro Metallurgical Co. has installed unique utility islands to bring air, water, power and gas services through the islands to equipment. Units are removable so that unobstructed space can be provided



INDUSTRY AND EDUCATION: Leading Wisconsin foundrymen met recently with engineering professors at University of Wisconsin to discuss industrial training problems. Left to right, standing, are F. W. Thayer; J. V. Olle; A. J. Salg and Profs. G. J. Barker, P. C. Rosenthal and R. W. Heine. Seated, left to right, are Ray Tanner; J. P. Keating; A. F. Pfeiffer; J. A. Gitzen and E. J. Walsh, Foundry Educational Foundation, Cleveland. All are members of the FEF Advisory Committee

Pacific Coast Foundries Set a Fast Pace

Kaiser, Graning, Rich and Commercial advances are typical of important strides in foundry mechanization in West Coast plants

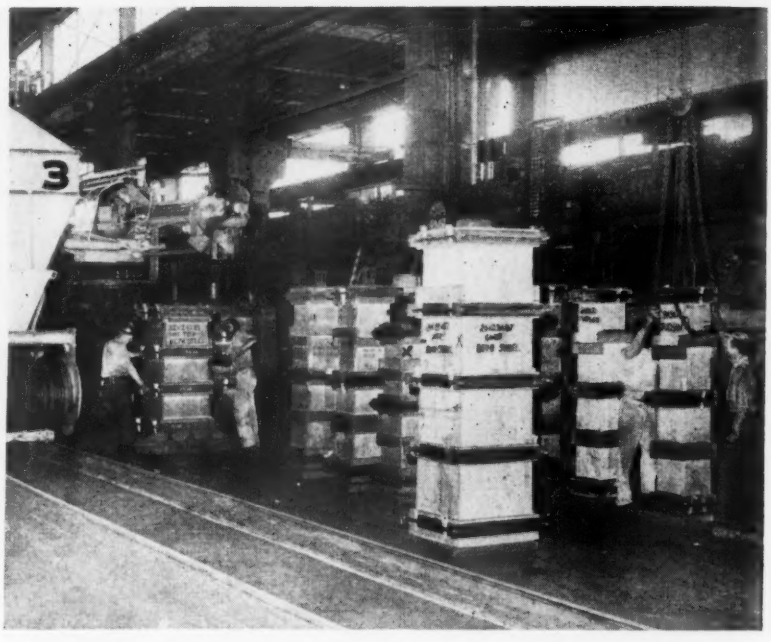
One of the most modern ingot mold foundries in this country — that of Kaiser Steel Company at Fontana, California — uses a Motive Speedslinger to ram both molds and cores. Ingot molds weighing up to 30-tons are produced. Kaiser has also recently completely modernized its sand preparation facilities. One Model "80" Speedmullor prepares all of the molding sand for Kaiser's ingot mold foundry.

The Graning Enameling Company, producer of enameled sanitary ware is really proud of the quality of their castings. In a field where castings must be extra-smooth and defect-free, Graning has built a reputation for top quality. To get that quality, Graning rams all of their molds with a Sandslinger and mulls all of their sand with a Speedmullor.

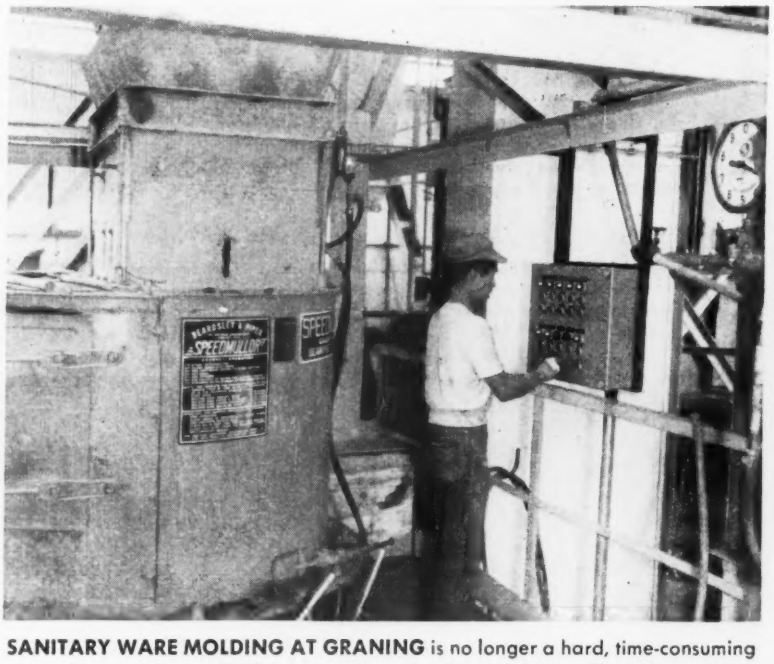
Few foundries have reached the degree of mechanization and automation as has the Rich Manufacturing Company of California in their Los Angeles plant. Their molds for soil pipe are produced on one of the most advanced lines in the country at the rate of one mold per minute. A B & P Swingslinger does all of the ramming and a Speedmullor prepares all of the molding sand to exacting specifications.

When the Commercial Enameling Company of Los Angeles wanted top foundry production to meet the increasing demand for their line of sanitary ware, they turned to B & P equipment and installed a B & P Slinger-Roto-Mold Unit with B & P Rol-A-Draw machine. This new unit rams all of their molds at a man-hour-rate-per-ton-of-castings of less than half of that of the old method.

These four foundries are just a few of dozens of progressive West Coast plants that look to Beardsley & Piper for Better Methods.



INGOT MOLDING AT KAISER, like that of virtually all ingot mold plants is handled by a Speedslinger. At Kaiser, they use a single Motive Speedslinger to ram both molds and cores for ingot mold castings weighing up to 30 tons. A B & P Model "80A" Speedmullor prepares all of this foundry's molding sand.



SANITARY WARE MOLDING AT GRANING is no longer a hard, time-consuming manual operation. A Model "60A" Speedmullor prepares all of the molding sand. A B & P Sandslinger-Roto-Mold Unit is used for the major portion of the foundry's molding. A 60% improvement in man-hour efficiency has been obtained with this equipment.

BEARDSLEY AND PIPER DIVISION PETTIBONE MULLIKEN CORPORATION
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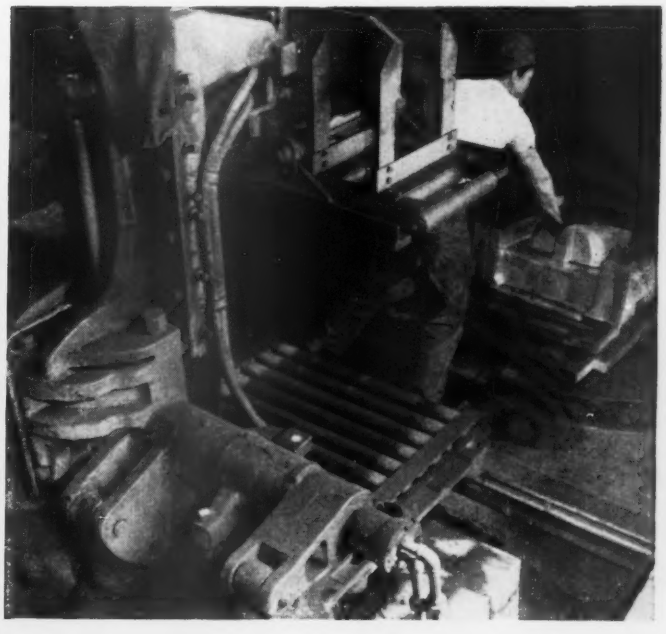
PIPE MOLDING AT RICH is handled on one of the most modern installations of its type ever made. Manual operations have been eliminated and every step is automatically accomplished. A B & P Automatic Swingslinger (enclosed at right in the photograph above) rams all molds assuring perfect uniformity on mold after mold. A single Model "80" Speedmullor prepares all of the molding sand for this operation.

COMMERCIAL GETS TOP PRODUCTION on a great variety of different patterns with their new Slinger-Roto-Mold Unit. Cope and drag patterns are mounted on the same pattern board. A single B & P Rol-A-Draw machine handles the rollover and draw of all molds made on the unit.



THE WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF FOUNDRY MACHINERY

Trouble Shooting

By C. W. AMMEN

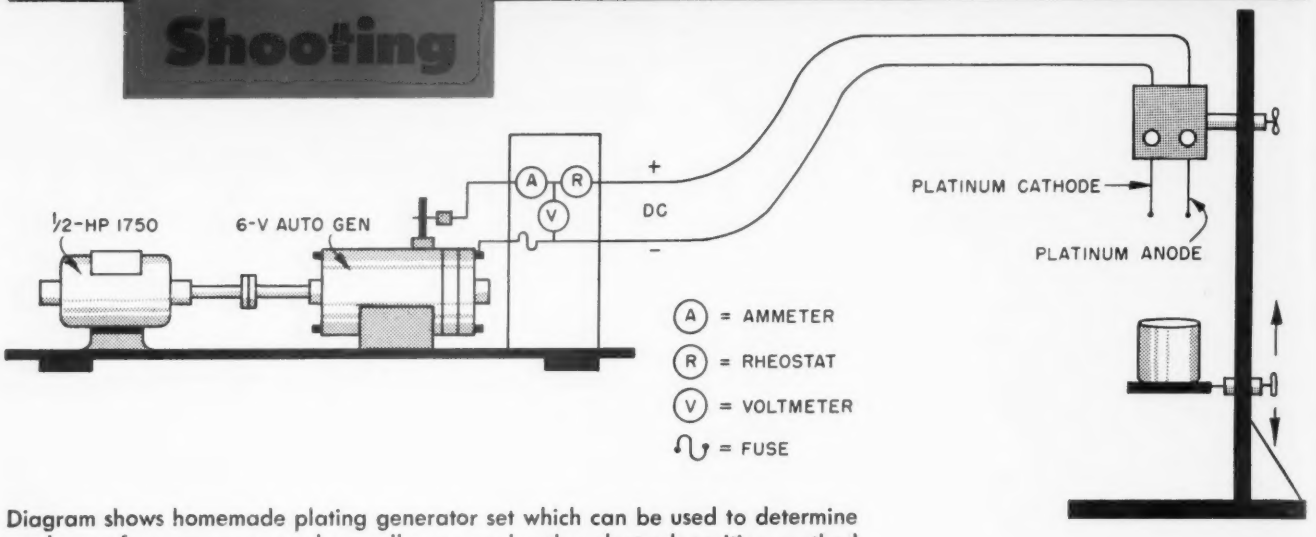


Diagram shows homemade plating generator set which can be used to determine analyses of common copper-base alloy scrap by the electrodeposition method

Analyzing Copper-Base Alloys

Dear Charlie:

We are interested in knowing whether we can set up a small lab in our foundry to run analyses of some common copper-base alloys. We realize we are not metallurgists or chemists, but currently we have to send borings out of town and wait for results. Also, we are not large enough to hire a chemist to do the work for us.

We melt ingot for the most part, but on occasion buy some scrap castings about which we are in the dark. Some time back I heard that we could dissolve copper or brass borings in acid and, like a plater, plate the copper and lead onto another object and get the percentage by weight. Knowing the copper and lead contents and the nature of the beast from which the borings came, we could just about guess its pedigree. Is this possible? Would appreciate some information on equipment needed and the process involved.

Sincerely,
Sam

Dear Sam:

I will try to answer your questions without writing a book on the subject, although I am only what is known as an occasional metallurgist. I don't see how a small lab could do you and your operation anything but good, if only to give you a better understanding of the metals you work with. Considerable skill and experience are required, however, to obtain consistently accurate results in analytical work, and you should do a lot of practicing with samples of known composition until you have everything down pat. Running a standard sample along with the unknown job for a while is a good way to check your procedures.

The use of plating practice or electrodeposition is quite commonplace in the qualitative analysis of nonferrous metals. The process and the equipment are relatively simple, provided one does not go into the chemistry and other technical points. Let's approach your problem by discussing only how to do it without going into the complex chemistry involved. The first area to cover is the equipment you must have. Probably the best idea is to get in touch with a reputable chemical supply house and ask for suggestions.

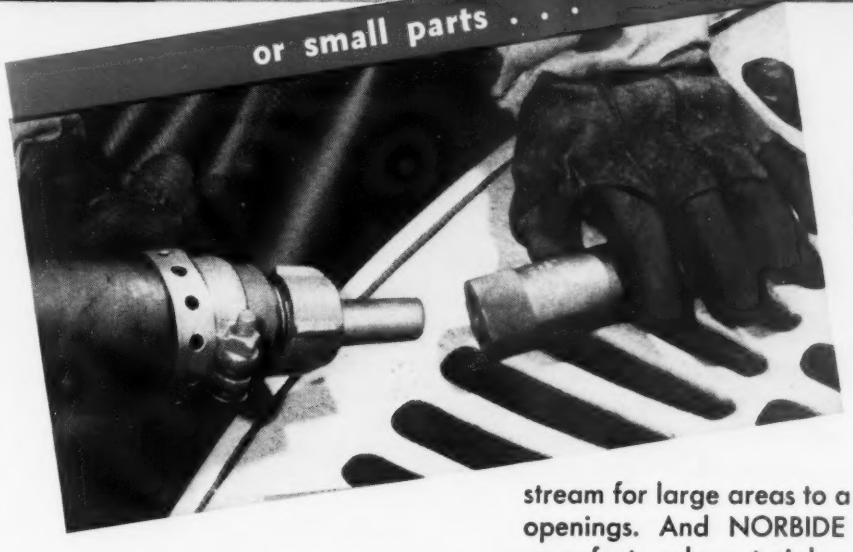
The most important piece of equipment necessary is a very accurate analytical balance. Regardless of how carefully you carry out your procedures, all is to no avail if you use a cheap balance. Final results depend on the accuracy of your balance and your skill and ability to weigh accurately. You can buy a balance accurate enough for your use for about $300.

Next, you need a plating generator set. Illustrated is the type of homemade set I have seen used successfully in several shops. It is an auto generator driven by a ½-hp, 1750-rpm motor. You can purchase a complete, self-contained electrodeposition unit designed just for analytical work, but to keep costs down, you can build the one shown, and it will do a fine job. You will need a cathode and an anode of pure platinum, preferably 50-mesh gauze, weighing about 20 grams, at about $5 per gram. Preferably, the analysis should be conducted in duplicate for checking, and it may be advisable, to save time, to have two cathodes and two anodes.

Your plating stand must be constructed so that the beaker containing the electrolyte may be moved up and down while the plating generator is in operation. In addition, you should have plenty of distilled water (used wherever water is mentioned), beakers of various capacities, graduates in different sizes, funnels, a wash bottle, one ring stand for your funnels and one for your bunsen burner, a good bunsen burner, several porcelain crucibles, a couple of graduated burettes, and an electric hot plate, plus such small supplies as watch glasses, glass stirring and pouring rods, filter papers of various textures (15-cm diam), litmus paper and necessary chemicals.

Before going into the exact procedure of performing a quantitative analysis, let's see what we are going to do. We will place a measured amount of borings in a solution from which various elements are removed by precipitation and electrodeposition. By adding reagents of known strengths to produce certain reactions, we can find the amounts of some elements which are in solution.

You should know a little about re-



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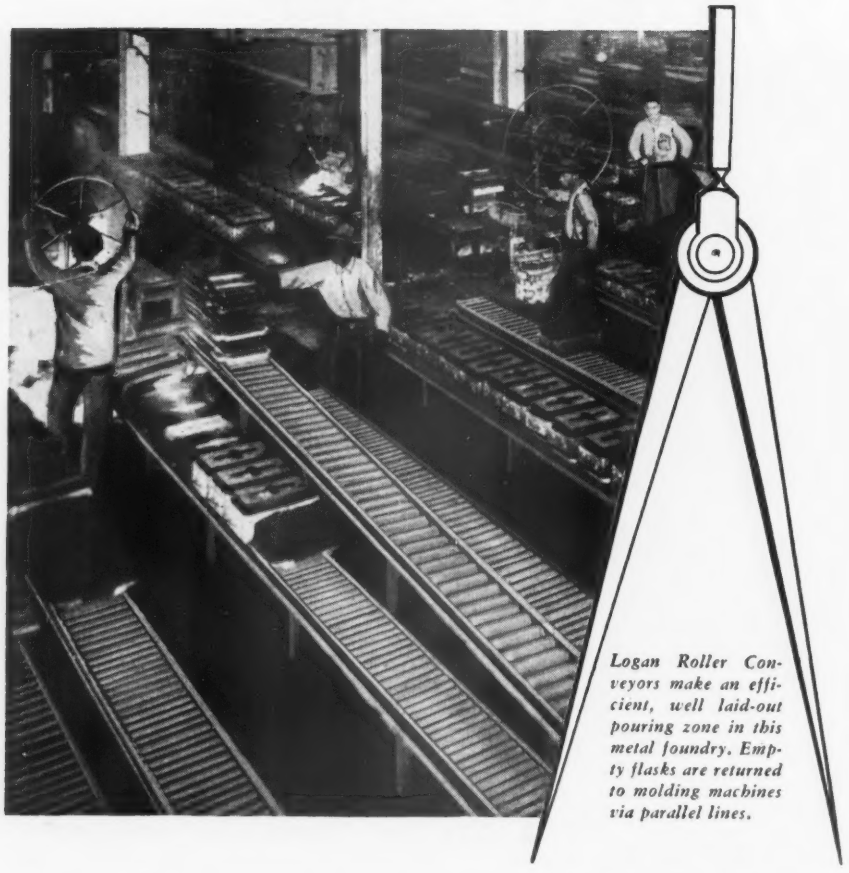


Logan Roller Conveyors make an efficient, well laid-out pouring zone in this metal foundry. Empty flasks are returned to molding machines via parallel lines.

in the same space

Increasing the output-per-square-foot of plant area is an established American business principle. A contributing factor is correctly engineered conveying equipment.

Logan Conveyors frequently save the cost of a foundry addition by handling a greatly increased volume of work in existing quarters. In any event Logan equipment steps-up output wherever used, relieves congestion, promotes a smooth, continuous flow along production lines.

There is a Logan Conveyor engineer near you, and remember you always get that certain plus value when you specify "Logan" Conveyors.

LOGAN CO., 580 CABEL ST., LOUISVILLE, KY.

Logan Conveyors

agents and their use. Reagents used for volumetric work must be of definite, known strength; they are called standard solutions. They can be purchased, or you can make them up yourself. Metal of known, certified analysis used for standardization purposes can be purchased from chemical houses or from the National Bureau of Standards, Washington.

A normal solution is denoted by the symbol 1N and contains in 1 liter the equivalent of 1 gram atom of replaceable hydrogen or its equivalent. With acids and bases containing only one hydrogen atom, a normal solution is made by dissolving the molecular weight of the compound, in grams, in 1 liter of distilled water.

For acids and bases with 2 atoms of hydrogen, only one-half the molecular weight of the compound is used. Reagent solutions also may be made in 0.1N or 0.01N, etc., strengths. The solutions also may be made to contain a certain weight of the chemical compound. Thus 1 cc, or ml, of the solution usually is equivalent to a fractional percentage of the element to be determined on the basis of a known weight of sample.

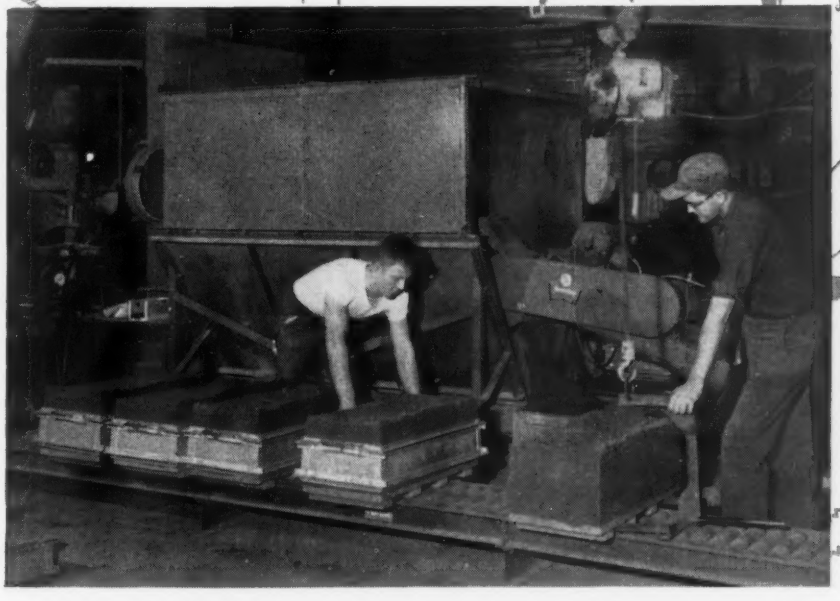
Describes a Titration

With the reagent of a known strength we perform what is known as a titration. It is the process of adding to a solution, using a burette, a reagent of a known strength, usually drop by drop, with constant shaking or stirring of the solution, so as to bring about a desired reaction. Completion of the reaction often is indicated by a sudden change in color. Color changes may be due to the reaction involved or may result from the presence of an added indicator such as a small amount of litmus, starch solution, methyl orange or phenolphthalein, to mention a few. The point at which the reaction takes place is known as end reaction. By knowing the strength of our reagent, the weight of our sample and the amount of reagent added to produce end reaction, we can figure the percentage of the element in question.

There are several ways to perform an analysis, but I'll explain only one since they all are basically the same. Incidentally, do not sacrifice accuracy for speed since accuracy is most important.

Go over your sample drillings with a magnet to remove any extraneous iron. The sample should be mixed thoroughly prior to weighing. Check the balance to insure it is operating

LET US TELL YOU ABOUT OUR OPERATION



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Muskegon, Michigan

properly, then weigh separately and record the weights of the platinum anode and cathode, which of course should be chemically clean and dry. Don't get them mixed up. Have everything clean and handy and in good working order.

To determine the amount of copper, lead, tin, zinc, iron and nickel in brass or bronze, the following procedures are employed. Copper and lead can be determined simultaneously by electrodeposition from one solution; so weigh a 2.000-gm sample into a 250-ml beaker and add 25 ml nitric acid (1 part acid and 1 part water). Heat on steam bath or hot plate and boil gently to expel brown fumes. Add 50 ml hot water and allow it to stand on the bath or plate for 1 hr. Add macerated, ashless filter paper pulp and filter off precipitated metastannic acid on a 15 cm ashless filter paper into a 250-ml beaker. Wash paper several times with hot nitric acid (1:99) and reserve filtrate and washings for later use.

Now transfer filter paper and contents to the original beaker and add 15 ml of sulphuric acid (1.84 sp gr) and 25 ml of nitric acid (1.42 sp gr). Heat until all organic matter is decomposed and transfer to a 400-ml beaker, diluting to 250 ml. Add sodium hydroxide (250 grams per liter) until the solution is alkaline and the tin hydroxide has dissolved. Add 20 ml sodium sulphide (250 grams per liter), stir thoroughly and digest on hot plate several hours until supernatant liquid is clear. Cool to room temperature, filter through close-textured filter paper and wash the precipitate with sodium sulphide (20 grams per liter). Dissolve residue in a few ml nitric acid (1:1) and add recovered Cu and Pb to filtrate previously reserved.

Add 1 drop 0.1N hydrochloric acid to the solution and dilute to 150 ml. Insert electrodes in solution, cover with pair of split watch glasses and electrolyze overnight at a current density of 0.5 amp per sq decimeter (4.6 amp per sq ft). When solution is colorless, wash down cover glasses, electrodes and the sides of the beaker and continue electrolysis until deposition of copper is complete as indicated by failure to plate on new surface when solution level is raised. When no copper appears, it can be assumed that all the lead also has been deposited. The electrolyte may be reserved for determination of zinc or nickel.

When deposition of copper is complete, with the current still on, lower the beaker slowly while washing the cathode with water. Remove the cathode, rinse it in water, and dip it in two successive baths of alcohol. Dry it in an oven at 110°C (230°F) for 3 to 5 minutes, cool and weigh the deposit as metallic copper. Weight of copper divided by 2 times 100 equals per cent copper.

Remove Anode Carefully

Remove the anode carefully, rinse it thoroughly with water and dry it at 110 to 120°C (230 to 250°F) for 30 minutes. The deposit is fragile and must be handled carefully. Cool the anode and weigh the deposit as PbO_2. Weight of PbO_2 times 0.433 times 100 equals per cent lead.

While tin can be determined gravimetrically, the following volumetric method described by Rapport in the August, 1953 issue of FOUNDRY is much more rapid and also is accurate. First, dissolve a 1.000-gram sample in a 500-ml Erlenmyer flask with 20 ml hydrochloric acid and 15 ml of 30 per cent hydrogen peroxide. When violent action ceases, place on hot plate until solution starts to boil clear. Add 80 ml hydrochloric acid (3:5), approximately 0.3 grams of mercuric chloride and 10 ml of 30 per cent hypophosphorous acid. Raise to a boil and continue boiling for 5 minutes or until solution is almost clear. Place under running water, keeping under a CO_2 atmosphere with addition of 20-grain sodium bicarbonate pills. Cool to ap-

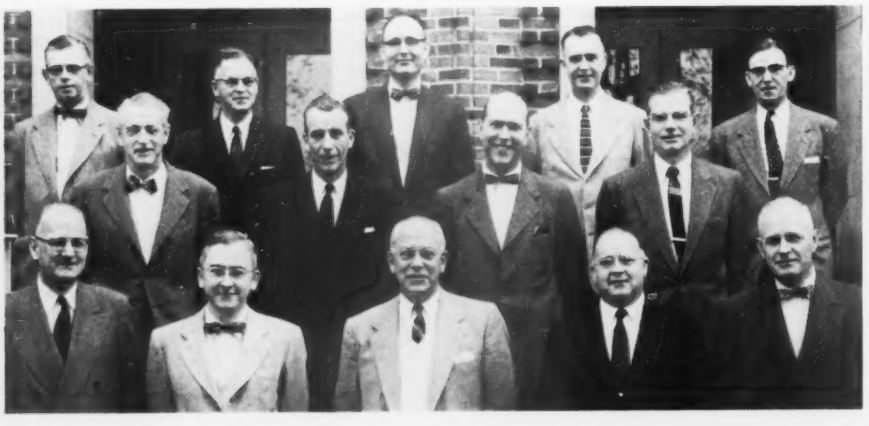
FEF INDUSTRY ADVISORY COMMITTEES MEET

Illinois and Cornell Groups Discuss Activities

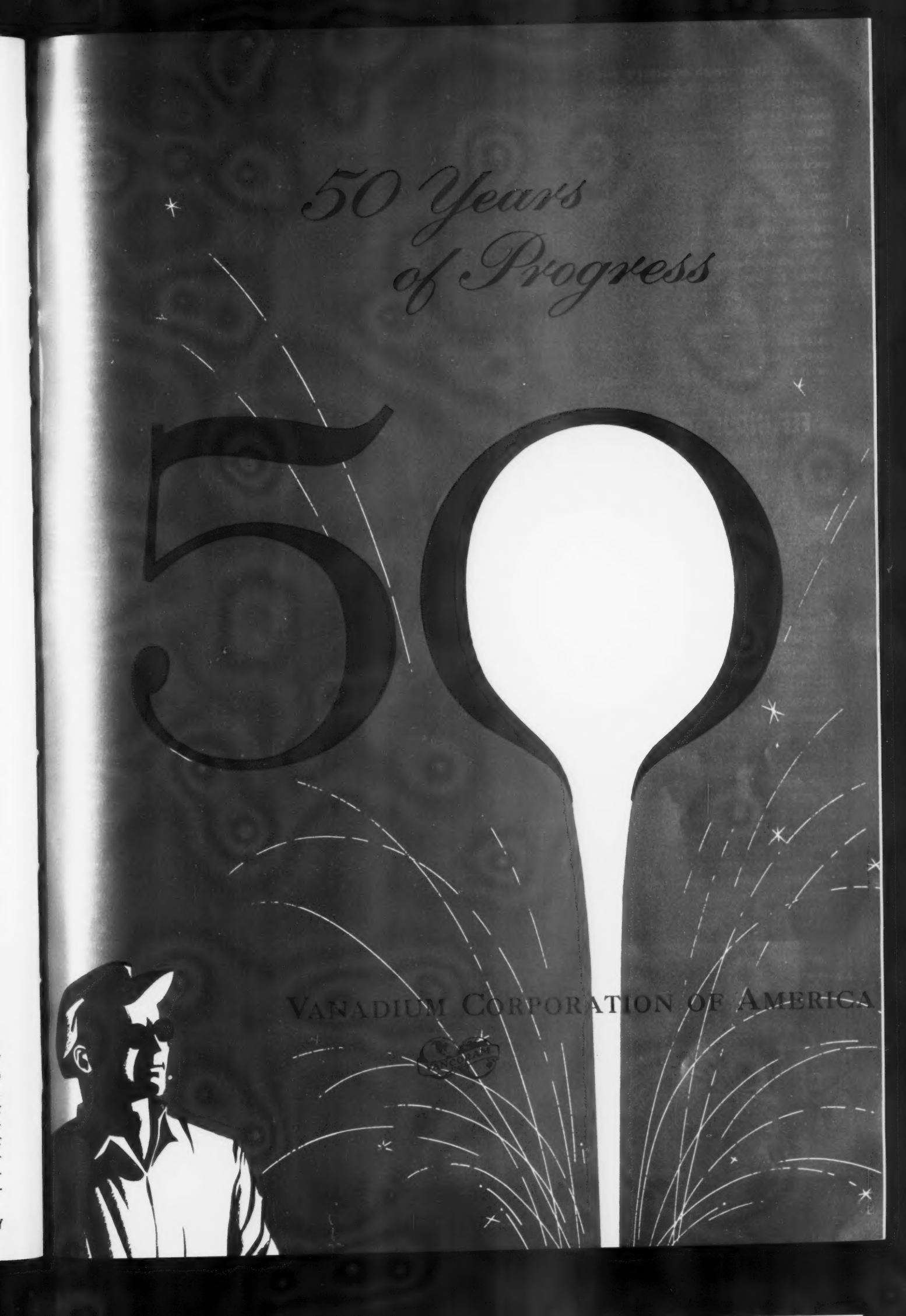
Recent Foundry Educational Foundation activities have included a meeting of trustees of the foundation with the University of Illinois FEF Industry Advisory Committee in Urbana, Ill., and a meeting of the Cornell University Industry Advisory Committee in Ithaca, N. Y.

The Illinois meeting represented the first official foundation activity at the school since its affiliation with the FEF last summer. Professors James L. Leach and Roy W. Schroeder outlined plans for foundry activity during the coming year and discussed foundry courses, development of student interest, laboratories and equipment and summer and permanent placement. The trustees played host to the committee at a luncheon in the Illini Union Building, as shown above.

Discussion at the Cornell meeting, led by R. W. Crannell, vice president, Lehigh Inc., Easton, Pa., centered around current and anticipated manpower requirements of the foundry industry and effective employment of students on both summer and temporary bases. Prof. M. S. Burton, department of metallurgical engineering, reviewed enrollment statistics, outlined the content of foundry courses and pointed out areas where the committee could provide significant assistance to the university program. The members of the committee are shown below.



50 Years of Progress



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We were privileged to take part in these and numerous other developments in the past half century, for their success depended in part on the ferro alloys, metals and chemicals which VCA helped pioneer and produce. Now . . . on the occasion of our fifty years of service to the Metals Industry, we look ahead to . . .

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proximately 15°C (60°F). Add 10 ml 50 per cent ammonium thiocyanate solution (500 grams per l), 5 ml 10 per cent potassium iodide solution (100 grams per l) and approximately 0.1 gram cold-water starch solution and titrate to a persistent blue with potassium iodate (1.8 gram of potassium iodate, 5 grams of potassium iodide and 1 gram of potassium hydroxide to 1 l water). The latter solution is standardized against an alloy containing a known amount of tin following the same procedure. Per cent of tin equals ml potassium iodate solution times standard factor times 100.

As mentioned earlier, the electrolyte from the determination of copper and lead may be used to estimate zinc or nickel. Exactly half of the electrolyte should be used for each. Place the solution in a graduate to ascertain the exact amount, perhaps adding a small amount of water to bring it to a definite mark such as 200 ml, and then take 100 ml for the zinc and 100 ml for the nickel. Each solution then will be equivalent to a 1.000-gram sample since a 2.000-gram sample was used originally.

How To Determine Zinc

For zinc, 15 ml sulphuric acid (1:1) is added, and the solution is evaporated to dense white fumes on the hot plate. Cool it to room temperature and add 15 to 25 ml hydrobromic acid. Evaporate cautiously to dense white fumes to volatilize tin, arsenic and antimony.

Cool the residue, add 100 ml water and digest until the solution is complete. Cool to room temperature and dilute to 200 ml. Pass in a rapid stream of hydrogen sulphide gas for 15 minutes to remove last traces of copper and lead and also tin, arsenic and antimony. Allow to stand for 2 hr and filter through a close-textured paper into a 600-ml beaker. Wash thoroughly with hydrogen sulphide wash water (10 ml sulphuric acid in 1 liter water, saturated with H_2S).

Boil filtrate and washings for 25 to 30 minutes to remove hydrogen sulphide. Cool and carefully neutralize with ammonium hydroxide (1:2), using methyl orange as indicator, and dilute to 400 ml. Add 1 gram 1N sulphuric acid for each ml of solution so that the solution has an acidity of 0.01N. Cool to room temperature and pass in a rapid stream of hydrogen sulphide for at least 30 minutes.

Allow white precipitate of zinc sulphide to settle and filter through a close-textured, ashless paper. Wash precipitate thoroughly with cold water to remove all traces of salts. Clean beaker thoroughly with policeman to remove all zinc sulphide.

Transfer paper and precipitate to a weighed porcelain crucible, dry on hot plate and heat cautiously to ignite paper, taking care that the sulphur fumes do not ignite. Finally place crucible and contents in electric muffle or over bunsen burner and heat at 950°C (1740°F) for 15 minutes. Cool and weigh as zinc oxide. Heat again for 10 minutes, cool and weigh. Repeat until a constant weight is obtained. Weight of zinc oxide times 0.8034 times 100 equals per cent zinc.

To determine the nickel, place the other half of the electrolyte in a 400-ml beaker. Add 10 ml tartaric acid (250 grams per l). Neutralize with ammonium hydroxide and add 1 ml in excess. Heat to 70°C (160°F) and stir in 5 ml dimethylglyoxime (10 grams per l), pouring directly into the solution, not down the beaker wall. Stir mixture vigorously and allow to cool to room temperature,

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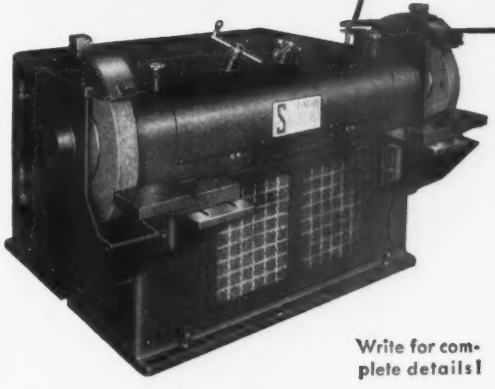

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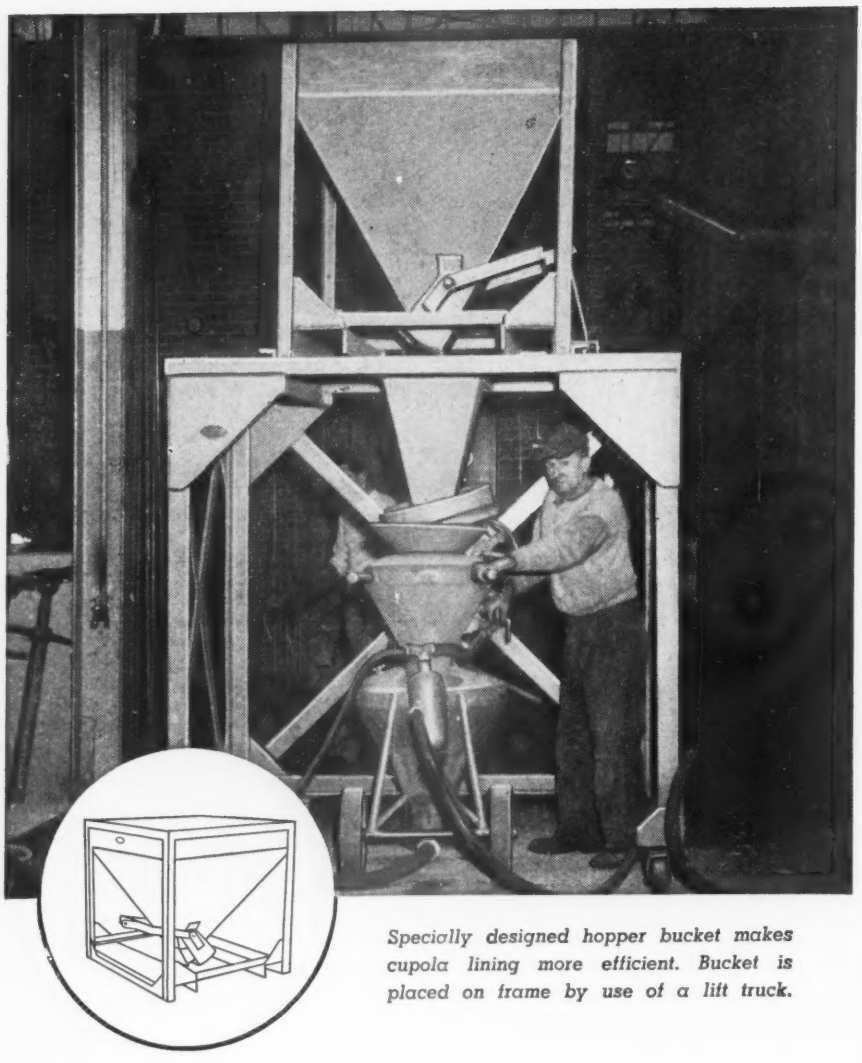

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stirring it occasionally. Filter, using a weighed Gooch crucible, and wash well with cold water.

Dry the precipitate at 150°C (300°F) to constant weight. Cool in a desiccator and weigh as nickel dimethylglyoxime. Weight of nickel dimethylglyoxime times 0.2032 times 100 equals per cent nickel.

How To Determine Iron

Iron is determined by placing a 5-gram sample, cleaned with a magnet, in a 250-ml beaker. Add 50 ml nitric acid (1:1) and heat to expel brown fumes. Dilute solution to 100 ml with hot water and digest metastannic acid on hot plate for 1 hr. Filter through double, close-textured paper into 400-ml beaker. Wash with hot nitric acid (1:99) and reserve filtrate.

Transfer paper and contents to original beaker. Add 15 ml nitric acid, then 10 ml perchloric acid. Heat gently until white fumes appear, cool, and wash down sides of beaker. Cover and add 10 ml hydrobromic acid. Remove cover glass and boil gently until white fumes appear. Repeat hydrobromic acid treatment to expel last traces of tin and antimony. Add 15 ml water and heat to dissolve soluble salts. Filter if silica is present and combine the solution with the filtrate previously reserved.

Dilute the solution to 150 ml. Add ammonium hydroxide until the solution is slightly but distinctly alkaline and boil it gently for a few minutes. Remove beaker from hot plate and allow precipitate to settle for a few minutes. While it is hot, filter through medium-textured paper. Wash the breaker and precipitate a few times alternately with ammonium chloride (20 grams per l) and hot water to remove most of the soluble salts.

Dissolve the precipitate through paper with 20 ml hot hydrochloric acid (1:1) and wash it thoroughly with hot water to remove the last traces of iron, collecting the solution and washings in original beaker. Repeat the procedure described in previous paragraph. Then dissolve the precipitate in hot hydrochloric acid (1:1) and wash it thoroughly with hot water, collecting solution and washings in the original beaker.

Evaporate the solution to 15 to 20 ml and wash down the sides of the beaker. Heat to boiling and add stannous chloride (12.5 grams of stannous chloride in 25 ml hydrochloric acid diluted to 250 ml; keep in well stoppered bottle) drop by

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drop while swirling the beaker over a white background until the yellow color of iron chloride disappears. Add 1 drop of stannous chloride in excess, but no more.

Dilute the reduced solution to 50 ml, cool it to room temperature, stir, and add at one stroke 10 ml of a saturated solution of mercuric chloride (60 to 100 grams mercuric chloride dissolved in 400 ml hot water, then cooled to room temperature). The resultant precipitate should be pure white in color, and in amount should be preferably not more than enough to give a pearly opalescence. If precipitate is gray or dark, too large an excess of stannous chloride has been used, and it will be necessary to start with a new sample. To the properly reduced solution, add 10 ml phosphoric acid (1:3) and 4 drops sodium diphenylamine sulphonate indicator (2 grams per l).

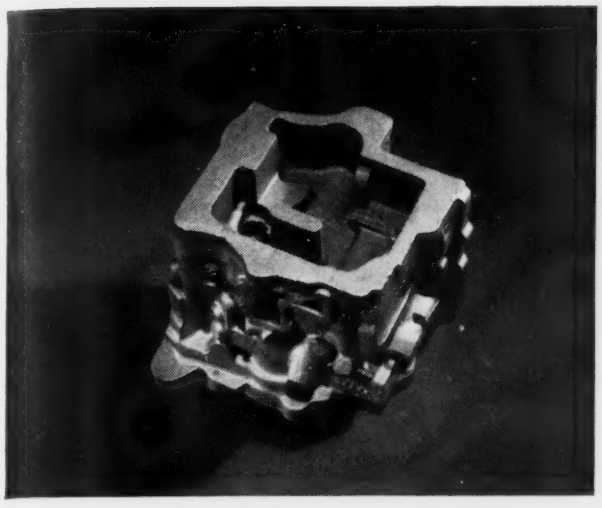
Volume of the solution should not exceed 100 ml. Titrate slowly with 0.01 N potassium dichromate (4.9035 grams of carefully dried potassium dichromate dissolved in water and diluted to 1 liter) while stirring constantly until the color of solution turns from green to gray-green. Continue the titration drop by drop until the first tinge of purple or violet-blue appears. Per cent iron equals ml potassium dichromate times 0.000112 times 100.

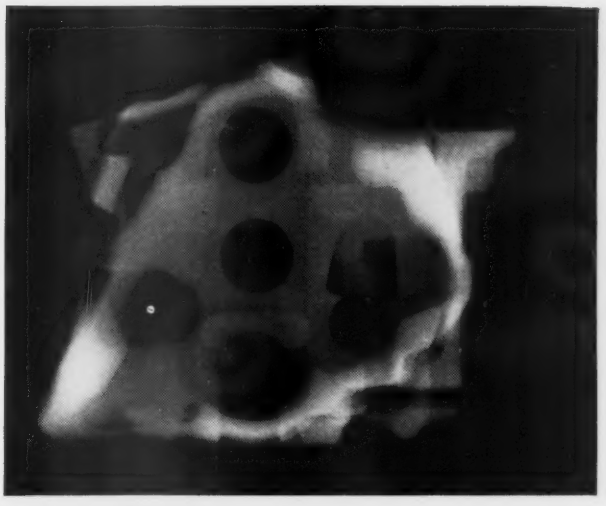
This, Sam, is only basically how it is done. After you have set up, get the help of a chemist or metallurgist to explain and demonstrate to you the fine points involved. I doubt that you can guess the remaining composition by plating off the copper and lead. You leave a pretty big field for guessing. You might be able to separate the lead-free alloys from the leaded alloys, at best. If you run tin, lead and copper, you could give a little better guess, but having gone this far, you might as well go ahead and run iron and nickel.

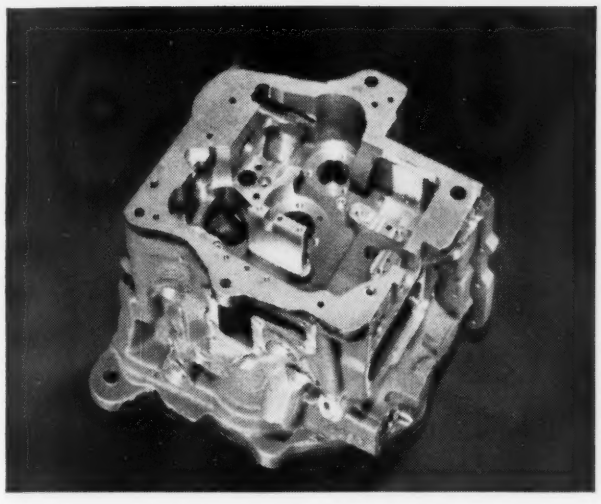
Sincerely,
Charlie

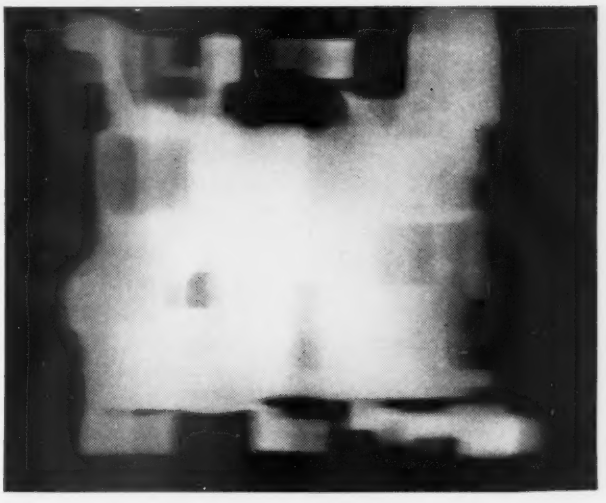
Offers Papers on Magnesium

Bound copies of all papers presented at the 11th annual convention of the Magnesium Association in New York on Oct. 31 and Nov. 1 have been published in a 140-page volume. Charts, graphs and illustrations are included with the 12 papers. Copies are available from the office of the association, at 122 East 42nd St., New York 17, for $5.









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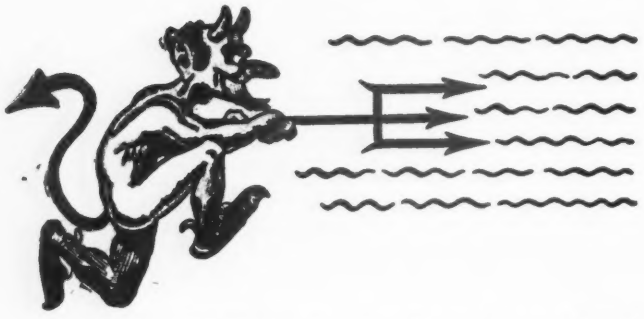

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This new head compound saves feeding metal in risers or feeding heads which can now be reduced in height 40 to 70%

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THERMOTOMIC HOTOP LIQUIDIZER BRAND "B" SHOULD BE USED ON RISERS UNDER 4 INCHES IN DIAMETER GUARANTEED TO PRODUCE SOLID CLEAN CASTINGS

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SOFFEL'S EXOTHERMIC CARBON FREE LIQUIDIZER is the leader in major foundries for use on both ferrous and non-ferrous metals and also in ingot production. It is the original scientific non-carbon, exothermic compound for feeding heads and risers.

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SOFFEL'S THERMOTOMIC COMPOUND

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FOR ALL METALS and ALLOYS

THERMOTOMIC COMPOUND is a patented Exothermic compound that can be molded into any desired shapes and used as feeding ring inserts under risers or as facing application where it is desired to maintain fluidity of the casting metal. THERMOTOMIC permits reversal of the trend towards large feeding heads and risers, making it possible to use heads that are shorter and more compact with 1½" feeder openings.

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NOTE: SOFFEL'S CARBON FREE LIQUIDIZER NO. 5 is recommended for use on top of feeding heads in conjuction with THERMOTOMIC COMPOUND. For aluminum castings, use THERMOTOMIC ABC and AL-X31 LIQUIDIZER. When ordering a trial sample, advise the kind of metal to be used on.

U. S. Patents No. 2,490,327 and No. 2,500,097

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Wisconsin Regional Meeting Planned for Feb. 9-10

The 19th annual Wisconsin Regional Foundry Conference will be held Feb. 9-10 at Hotel Schroeder, Milwaukee, under sponsorship of Wisconsin Chapter of the AFS and the University of Wisconsin. Conference chairman is Prof. George J. Barker, University of Wisconsin, and co-chairman is N. N. Amrhein, Federal Malleable Co., West Allis, Wis. L. J. Woehlke, Grede Foundries Inc., Waukesha, Wis., is program chairman.

Besides a general meeting, luncheons each day and a banquet on the evening of Feb. 9, four sets of sectional meetings will be presented. These meetings will include simultaneous gray iron, steel, malleable, nonferrous and pattern sessions. Registration for the full program is $12.

Thursday, Feb 9

9 a.m.—Registration

10 a.m.—Welcoming Address, Dean Kurt F. Wendt, University of Wisconsin.

10:40 a.m.—General Meeting: **Noise, a Problem in Industry,** Herbert J. Weber, AFS.

12 Noon—Luncheon: **Football—Past and Future,** Coach Milton Bruhn, University of Wisconsin.

2:15 p.m.—Sectional Meetings
Malleable Iron: **Processing of Pearlitic Malleable,** Lyle R. Jenkins, Wagner Malleable Iron Co., Decatur Ill.
Nonferrous: **Effect of Gating Design on Casting Quality,** Hans J. Heine, AFS.
Gray Iron: **Metallography of Cast Iron,** Philip C. Rosenthal, University of Wisconsin.
Steel: **Casting Surface, Finish, Tolerance and Precision,** Clyde Sanders, American Colloid Corp., Chicago.
Pattern: **Epoxy Plastic Pattern Equipment,** Martin C. Ehrman, International Harvester Co., Milwaukee.

4 p.m.—Sectional Meetings
Malleable Iron: **Casting Scrap Due to Cores: Cause and Cure,** R. J. Mulligan, Archer-Daniels-Midland Co., Minneapolis.
Nonferrous: **Synthetic Sand Practice,** Victor M. Rowell, Harry W. Dietert Co., Detroit.
Gray Iron: **New Developments in Melting Equipment,** H. W. Schwengel, Modern Equipment Co., Port Washington, Wis.
Steel: **Welding in the Foundry,** W. G. Rinehart, Harnischfeger Corp., Milwaukee.
Pattern: **Pattern Design Specifications,** E. A. McClintock, Belle City Malleable Iron Co., Racine, Wis.

6:30 p.m.—Banquet: **A Management Is as Good as Its Words,** Dr. Charles E. Irvin, Michigan State College, East Lansing, Mich.

Friday, Feb. 10

10 a.m.—Sectional Meetings
Malleable Iron: **The Duplex Method of Melting,** Eric Welander, John Deere Malleable Works, Deere & Co., East Moline, Ill.
Nonferrous: **Brass and Bronze Foundry Practice Emphasizing Quality and Quality Control,** F. L. Riddell, H. Kramer & Co., Chicago.
Gray Iron: **Gating and Risering Discussion,** Harry H. Kessler, Sorbo-Mat Process Engineers.
Steel: **Magnetic Particle Inspection of Steel Castings,** R. O. Schiebel, Magnaflux Corp., Chicago.
Pattern: **Production Pattern Equipment as Used at Caterpillar Tractor Co.,** Robert L. Selberg, Caterpillar Tractor Co., Peoria, Ill.

12 Noon—Luncheon: Speaker to be announced later.

2:30 p.m.—Sectional Meetings
Malleable: **Scrap Reduction Methods,** Cy Semrau, Hill & Griffith Co., Cincinnati.
Nonferrous: **Information Panel,** Hans Heine, F. L. Riddell and Victor Rowell.
Gray Iron: **Almost Every Foundry Can Have Improved Sand,** Earl E. Woodliff, Foundry Sand Service Engineering Co., Detroit.
Steel: **Deoxidation of Steel for Castings,** F. W. Boulger, Battelle Memorial Institute, Columbus, O.
Pattern: **Pattern Equipment for Shell Molds and Shell Cores,** Harry Weaver, Brillion Iron Works, Brillion, Wis.

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"IT PAYS TO PLAN WITH PLANET"

Second-day luncheon head table had, left to right: Prof. J. F. Wallace, Dept. of Metallurgical Engineering, Case Institute of Technology; Dean Elmer Hutchisson, Case graduate school; Conference Chairman L. T. Crosby, Sterling Wheelbarrow Co.; R. C. Clark, Ohio Bell Telephone Co., speaker; Prof. A. R. Troiano, head of Case Metallurgical Dept., and Dean K. B. McEachron Jr., Case undergraduate school

Ohio Regional Foundry Conference

Covers Research, New Developments and Operations

By EDWIN BREMER, ROBERT H. HERRMANN
JACK C. MISKE and KENNETH L. MOUNTAIN
FOUNDRY

SEVENTH Ohio Regional Foundry Conference was held on the campus of Case Institute of Technology, Cleveland, Oct. 20-21. Two luncheons, a dinner and 18 technical sessions were provided for the 348 foundrymen present.

Conference was sponsored by Northeastern Ohio, Canton, Central Ohio, Toledo and Cincinnati chapters of the AFS in co-operation with Case Institute. General chairman was Lewis T. Crosby, Sterling Wheelbarrow Co., Cleveland. Associate chairman was J. F. Wallace, Case Institute, and program chairman was Alexander D. Barczak, Superior Foundry Inc., Cleveland.

The conference opened with a word of welcome from T. Keith Glennan, president, Case Institute, who spoke briefly of his experiences at the recent Atomic Energy Conference and of the impact of metallurgy upon the growth and development of the world's industrial powers.

At the opening general session, T. W. Curry, director of research and development, Lynchburg Foundry Co., Lynchburg, Va., spoke on **Applied Research and Development in the Foundry Industry.** Mr. Curry pointed out that industrial progress comes about only through basic research. Today's consumer, he said, is demanding more from the company's product, and in the future the consumer likely will become even more demanding.

To meet this consumer demand, it is essential that manufacturing research center around every-day production to improve manufacturing control and product quality, increase use of the product and improve its end-use.

At the opening day luncheon, Lewis T. Crosby, conference chairman, presided and introduced Bruce Simpson, National Engineering Co., Chicago, national AFS president, who

Bruce L. Simpson, national AFS president, was the speaker at the first-day luncheon meeting

This is part of the registration committee. From left to right, seated: Charles E. Coulter, Archer-Daniels-Midland Co., and Donald K. MacDonald, Ford Cleveland Foundry. Standing: James L. Schwalm and Tom Brown, Federal Foundry Supply Co.; Norman J. Stickney, Sand Products Co.; John Sibbison Jr., Kerchner Marshall & Co., Wayne C. Johnson, Walter C. Best Inc.

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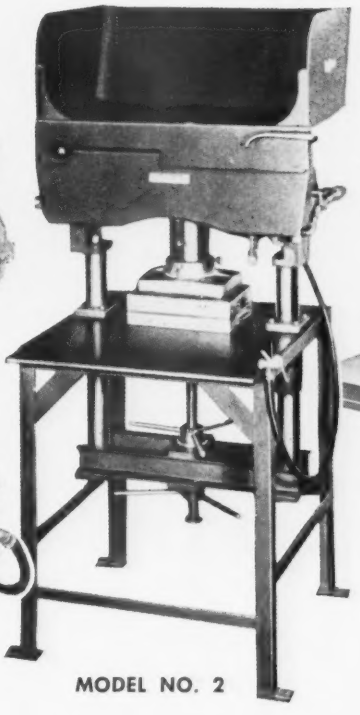

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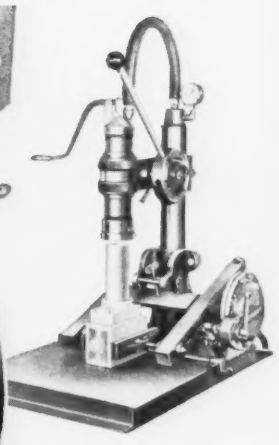

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talked briefly on the opportunities that the AFS presents to foundrymen to be of service to others in the industry.

Gray iron sessions opened with a paper on **Shell Molding and Shell Cores** by William J. White, Shallway Corp., Connellsville, Pa. He reviewed progress in equipment, materials and methods. Shell molding has found a definite place in the foundry industry, he said, and its use in producing larger castings is indicated by the fact that a western Pennsylvania foundry is pouring a 420-lb steel casting in a 24 x 36-in. shell mold.

Many foundries are interested in the use of shell cores. Although shell cores offer advantages in some instances, their use in any given foundry should be studied by someone familiar with the process. These questions need to be answered: Will shell cores save metal or machining? Will they solve casting cleaning problems? Will they increase production and casting quality? What will the over-all cost be?

Karl G. Presser, Gray Iron Research Institute, Columbus, O., discussed **Cupola Operation** at the second session. He stressed the importance of weighing cupola charges accurately—that is, specifying the correct weights of components, then checking to see that the weighing is done properly.

Home scrap should be identified by analysis and the analysis of purchased scrap should be specified and checked. Mr. Presser advocated keeping a graph record on the analysis of iron when tapped. Trends in the analysis can be compared with the raw materials, so that any effect a new shipment of coke or metal may have on the iron can be detected readily.

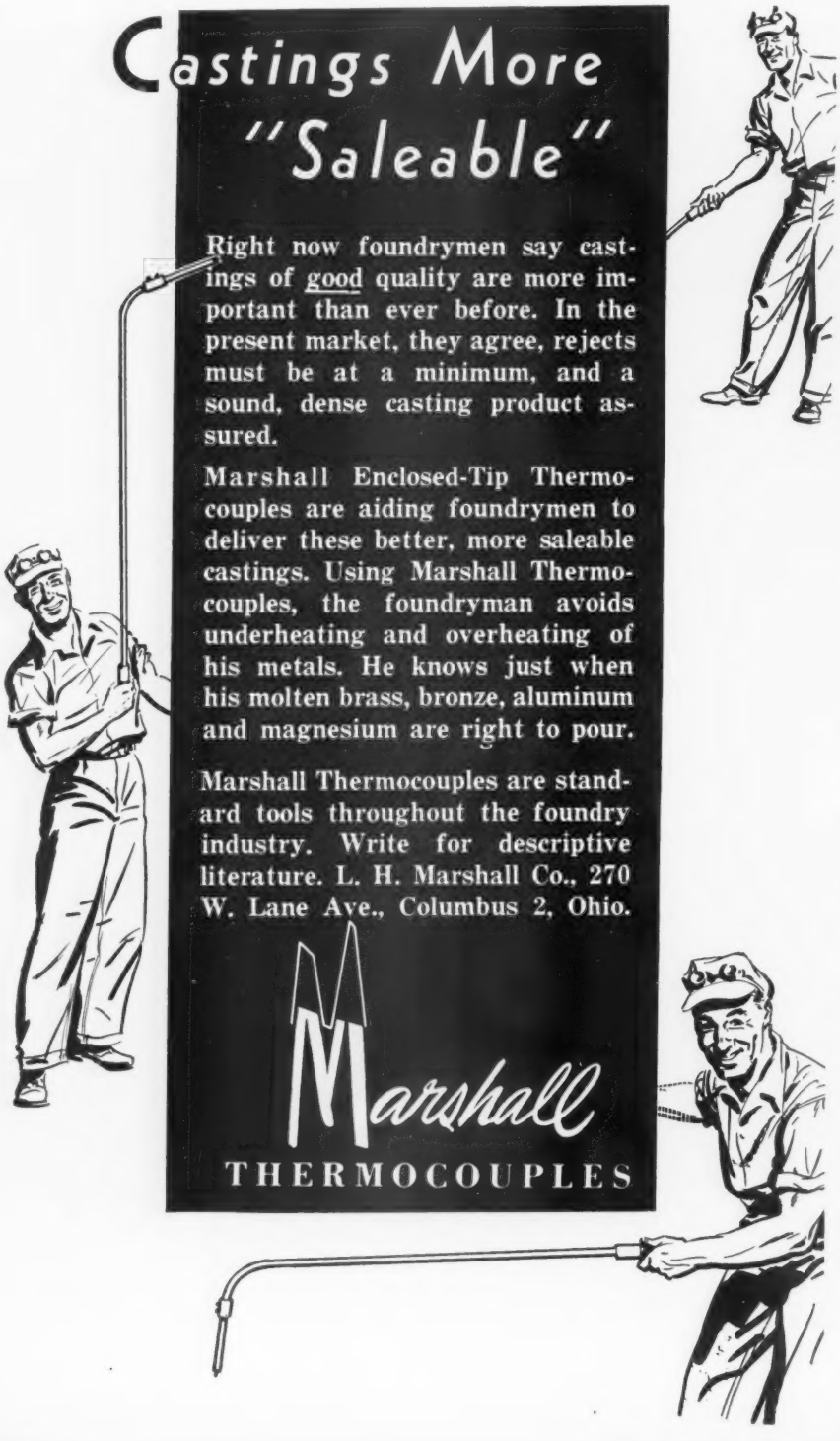
The speaker also commented on the importance of the proper air-

T. R. Reid, Ford Motor Co., was the conference banquet speaker

coke ratio. Air volume should be adjusted in accordance with the amount of iron to be melted per hour. He cautioned against arbitrarily adding coke if the iron is cold, for the iron may get colder. The proper solution is to increase the blast.

At the closing gray iron session, speakers were Tom E. Barlow, Eastern Clay Products Co., Chicago, and Michael Bock II, Exomet Inc., Conneaut, O. Mr. Barlow's topic was **High Pressure Molding,** the method of green sand molding which uses a fine, uniform sand, close pattern tolerances and uniform ramming. Fine controls make possible castings with superior surface finish and good tolerances. Pressures vary from 80 to 600 psi. Mr. Barlow described the progress the method has made recently and predicted its increased use.

Mr. Bock prefaced his discussion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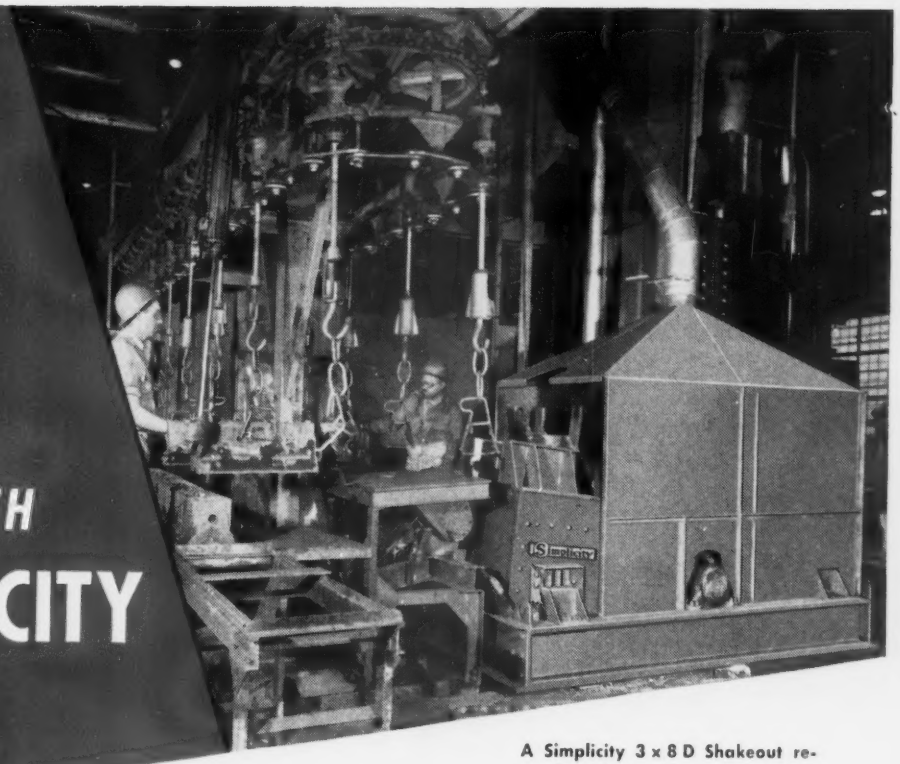

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of **Exothermic and Insulating Materials** with a showing of slides illustrating the mechanism of solidification and some of the problems it entails. Heat loss from exposed, open-top risers is by radiation and conduction, but loss by radiation is by far the most important. Because loss by radiation is largely through the top, insulation at the sides is not adequate.

Such insulation raises total solidification time for iron about 50 per cent. A shield on the top more than doubles the time, however, and use of insulation and shield together increases it nearly nine times. Exothermic materials are too expensive for standard use, but are a tool which can do a job when necessary. Sometimes insulation, which is cheaper, is enough to do the job.

At the first malleable iron session, A. C. Hensel, personnel director, Albion Malleable Iron Co., Albion, Mich., discussed **Safety.** Mr. Hensel elaborated upon the safety program at Albion where since 1948 the frequency rate has dropped from 88 to 7.6 lost-time accidents per million man-hours worked.

Such success results from continuing top management interest and active participation in safety education. Safety is considered to be a major cost of production. Company foremen undergo training that constantly reminds them to spot the hazard, apply the correction, furnish protection necessary and enforce the protection. In closing, the speaker said that in relation to other costs of doing business, a good safety program is inexpensive.

The second paper was presented by R. A. Witschey, ceramic engineer, A. P. Green Fire Brick Co., Mexico, Mo., who discussed **Refractories for Malleable Melting and Annealing.**

Slides and charts were shown covering refractories classified according to their chemical nature, mineralogical composition and physical form, grain structure, manufacturing methods and properties. Correct use of mortars in side walls, tops, front walls, arches and openings was illustrated as were various types of bottoms and refractories used in their makeup. Characteristics of refractories used in batch melting furnaces, duplexing furnaces, annealing furnaces and electric melting furnaces also were discussed.

At the final malleable session Emil Romans, National Malleable & Steel Castings Co., Cleveland, discussed **Casting Defects.** Gist of Mr. Romans' paper was that the day of the all-around foundryman is gone and

that responsibility for scrap must lie with supervision—that is, with foundry engineers, line foremen and casting designers. Among production employees, each man does just one job and knows nothing of what others do. His supervisor is the man who must have a grasp of the whole process and must make constant, regular checks to insure that each step in the production of castings is carried out properly. A molder, for example, uses the sand and the cores given him and has no personal control over their quality—but his supervisor does.

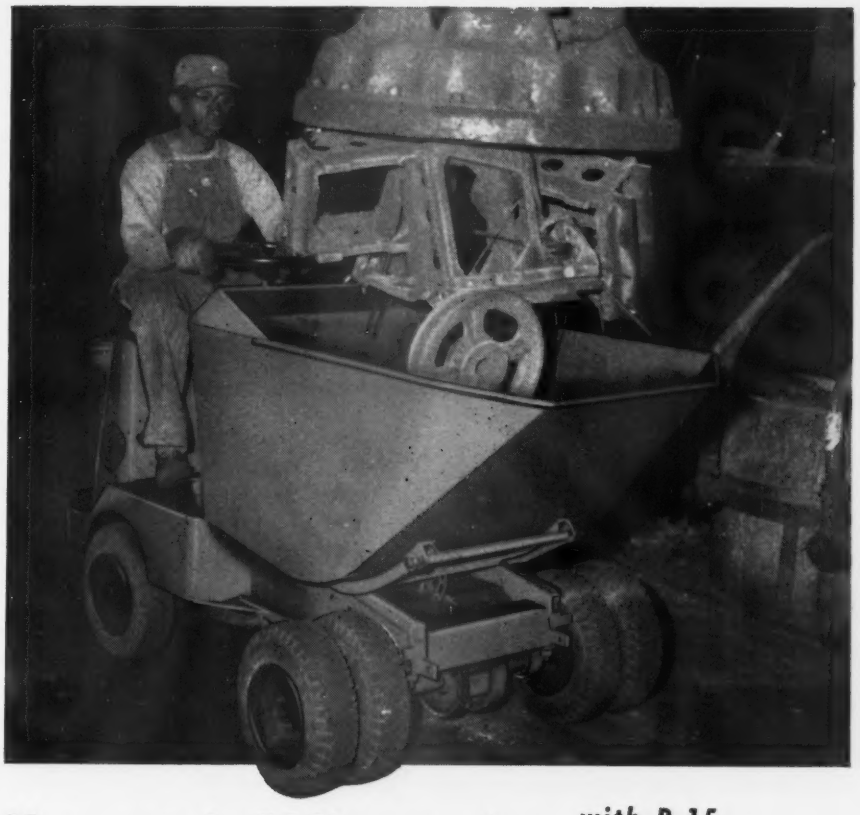
Malleable Iron Finishing, according to Earl M. Strick, Erie Malleable Iron Co., Erie, Pa., actually begins with the pattern. It also includes molding and coremaking operations since they all relate to the kind of casting sent to the finishing department. Close co-operation of those departments will aid in improving casting appearance and lowering cost of the final operations.

Hard iron inspection is one of the most important of all finishing operations. Gates which are not too large can be removed economically by hard iron grinding. However, the hazards are breakage in handling and heat checks. Grinding in the hard state supplies a better looking casting since annealing covers the grinding marks. Whether grinding is on hard or soft castings, the keys to low costs are proper grinding equipment operated at correct speeds with ample horsepower, good safety guards and good cutting wheels.

If gates are to be removed by shearing, careful consideration should be given to gating and risering the pattern. Less skill is required in shearing than in grinding.

At the Thursday conference dinner, T. R. Reid, Ford Motor Co., Detroit, stated that American businessmen are real public servants but receive little recognition in that field, as indicated by a survey on organizations doing the most for people. Returns showed the public voted 47 per cent for labor, 38 per cent for government and 15 per cent for business. Mr. Reid pointed out that business by necessity is forced to carry on research to develop better products in order to stay in business.

In four technical sessions steel foundrymen listened to discussions on properties, melting practice, calculations on risering, and use of exothermic materials. In the first session, John B. Caine, Cincinnati, talked on **Castings vs Forgings** and said that physical properties commonly used for competitive evalua-



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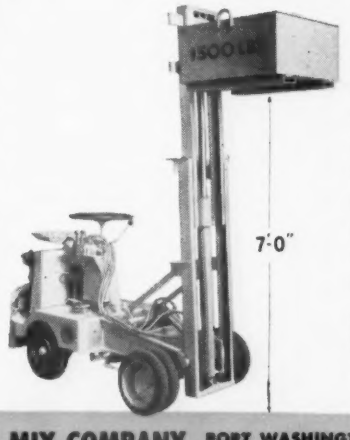

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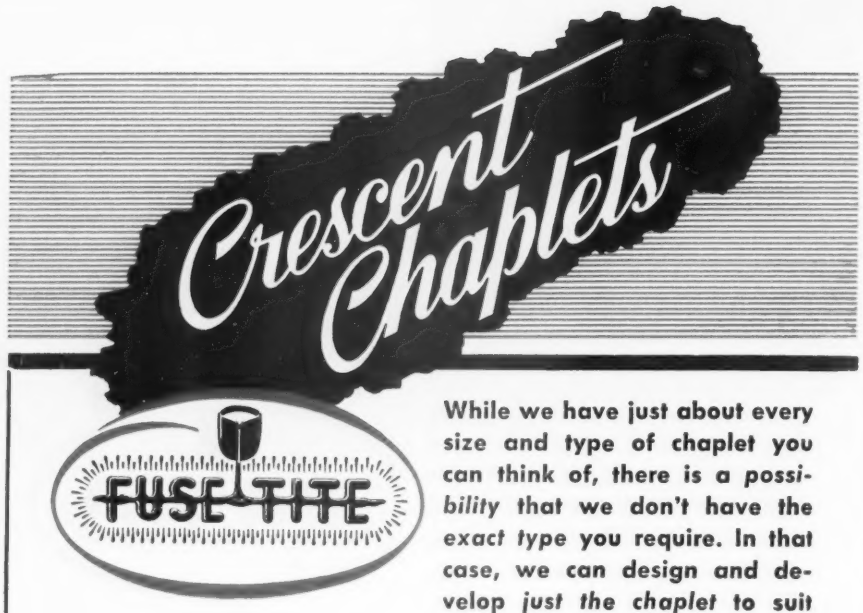

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tion of cast and wrought materials usually under-rate castings and over-rate wrought materials. However, the more exact measure of serviceability or service "toughness" is found in resistance to brittle failure under stress raisers and in fatigue strength.

Brittle failure in steel castings can be eliminated by addition of suitable alloys and heat treatment, but not so easily in wrought steel since alloys cause difficulty in forging, rolling and welding. Mr. Caine advocated use of Charpy or Izod tests for determination of resistance to brittle failure. He also urged that foundrymen work closely with designers to eliminate areas of stress concentrations in castings.

Arthur F. Gross, Ohio Steel Foundry Co., Springfield, O., in discussing **Melting Practice for Quality Steel Castings,** stated that three major factors are to be considered in choosing a suitable melting practice: 1. Physical requirements or ability of the melting practice to produce a steel which can be used to make a salable casting. Such a casting must have a suitable surface finish and be free from defects to such an extent that repairs can be made economically. 2. Metallurgical considerations, which involve ability of the metal to meet mechanical and physical test requirements such as tensile strength, ductility, impact resistance, etc. 3. Cost, where two practices are equally capable of meeting the first two requirements.

He mentioned that many fine practices have been described in the literature; the problem is to choose one which will answer most satisfactorily the factors mentioned. Constant survey of melting practice is advisable to meet changing conditions. Mr. Gross then considered causes of major defects resulting from variables in melting practice.

In a third session, H. F. Bishop, Naval Research Laboratory, Washington, spoke on **Practical Application of Riser Calculations.** He gave various formulas and curves developed from investigations which can be employed to simplify the calculations. These included the application of chills to increase feeding range of risers and aid in solidification of rib and boss hot spots, use of a shape factor based on length, width and thickness, and curves for determining riser diameter and height.

Concluding session related to application of moldable exothermic compounds. J. E. Gotheridge, Foundry Services Inc., Columbus, O., the speaker, stated that these materials are composed of aluminum and oxi-

dizing agents with a water-soluble binder and other materials to give necessary permeability, moldability, etc. Ramming to shape should be light since hard ramming results in difficulty in ignition. Baking of molded shapes, such as sleeves, should be conducted at temperatures suggested by the makers since some types of materials tend to ignite at temperatures over 400°F, whereas others will withstand baking up to 650°F. Molded shapes should be stored in a dry place until use. Redrying before use insures elimination of moisture. Shapes allowed to stand in green sand molds over 5 hours may pick up moisture.

Mr. Gotheridge said that wall thickness in relation to diameter is important in sleeves made of moldable exothermic materials, and presented curves for determination of riser sizes as well as thicknesses of sleeve walls.

At a luncheon held Friday noon, Robert Clark, Bell Telephone Co., Cleveland, gave an interesting talk and demonstration on the comparatively new electronic device, the transistor. It is gradually replacing many of the vacuum tubes employed in radio, television, etc. Power consumption is about one-tenth of that required for vacuum tubes.

The first nonferrous discussion dealt with **Elimination of the Most Common Defects Found in a Nonferrous Foundry.** The speaker, William Ball Jr., R. Lavin & Sons Inc., Chicago, said that unusual inventions and methods are stimulating to the industry, but reduced costs and improved quality in foundry work can be achieved by proper application of known procedures. He then discussed proper practices in melting, molding and gating. Emphasis was placed on the importance of supervision's teaching workers to do jobs properly and checking to see that they follow instructions.

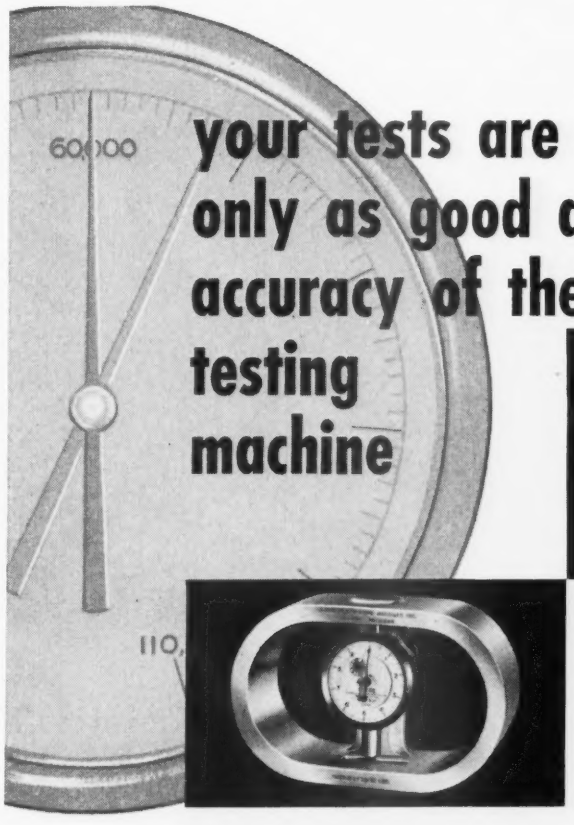
William Ball III, Hill & Griffith Co., Cincinnati, presented the second paper, **Some New and Different Ideas Pertaining to Nonferrous Synthetic Sands.** He favors an AFS 100, four-screen sand for nonferrous practice. He cautioned however, that such a sand should have no more than 3.5 per cent sand on screens 10 to 50. Otherwise casting surface finish will suffer. He discussed the use of clays with such a sand, saying that varying properties can be obtained with equal weights of different clays. He went on to cover proper mulling and molding techniques to achieve best results from a molding sand.

At the concluding nonferrous session, C. V. Knobeloch, R. Lavin & Sons Inc., presented the first paper, **Gating and Risering of Nonferrous Castings.** He discussed the various concepts of gating and touched upon their advantages and disadvantages. He then offered some techniques and outlined several rules of thumb which might be used to solve some common problems. He cautioned, however, that general rules must be altered in most cases to satisfy specific requirements.

James E. Reedy, Delhi Foundry Sand Co., Cincinnati, presented the final nonferrous paper, **The CO_2 Process.** It can be used for making cores and molds and for facing molds. Sands used should be free of clay and fines, and mixtures may include the usual dry additives such as pitch, seacoal or wood flour plus not more than 1 per cent water.

Care must be taken during mixing to avoid heat because it will dry out the mixture before use. Although sodium-silicate-bonded sands have a short shelf life, it can be extended to as much as 90 days by keeping the mixed sand in a closed container.

In hardening the cores with CO_2, over-gassing does not seem to be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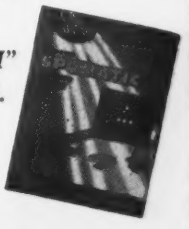

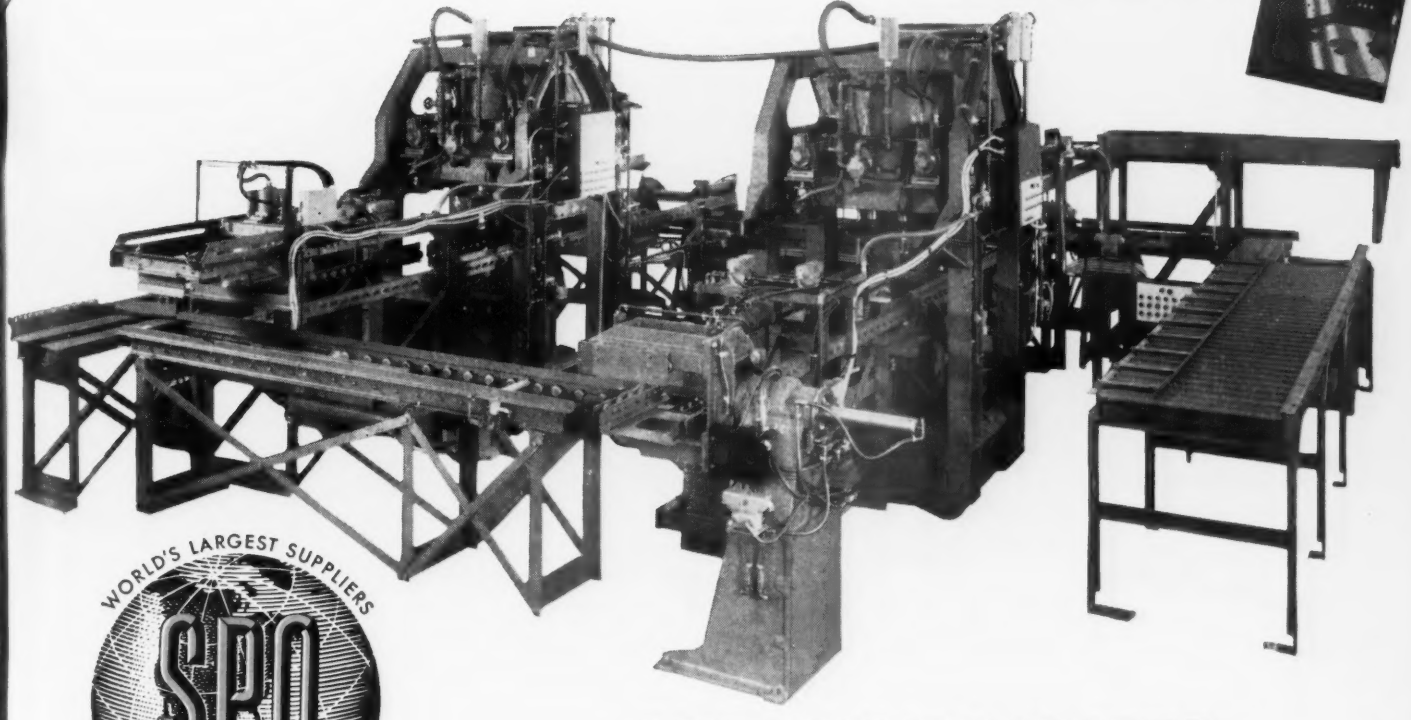

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detrimental, but under-gassing results in hard and soft spots, sand sticking to pattern equipment and a generally weak core. Patterns and coreboxes must have no back-draft, and many made for oil and clay-bonded sands have been used with no alteration. Some boxes must, however, be plated and extra venting added.

During discussion it was pointed out that tensile strength of these cores will increase 20 to 25 per cent if they are stored at room temperature for a short time. Furthermore, if more than 5 per cent sodium silicate must be used to get a satisfactory core, the sand contains too many fines or clay or has the wrong grain distribution. Drawing the core from the corebox can be facilitated by dusting the box with wood flour or adding glycerin to the sand mix.

At the final meeting of the conference, a joint session on Friday afternoon, George W. Schuller Jr., Caterpillar Tractor Co., Peoria, Ill., spoke on **Patternmaking.** Mr. Schuller emphasized the need for good patterns, even for one casting. Methods can vary, but quality can not. After a discussion of the operation of the Caterpillar pattern shop, Mr. Schuller described the qualifications of a good patternmaker, who must be a proud, capable craftsman.

Industrial Furnaces Get Hot

Sales of industrial furnaces in the first ten months of 1955 totaled $70,930,245 compared with $36,295.519 for the same period in 1956. This pace, according to the Industrial Heating Equipment Association, is breaking all peacetime records and is ahead even of the Korean War year of 1952.

Book Review

Shop Mathematics, by Claude E. Stout, 282 pp., published by John Wiley & Sons Inc., New York. Price $3.70.

This book concentrates on principles, particularly as they apply to situations that confront craftsmen on their jobs. Originally prepared for the apprentice training program of General Motors Institute, Flint, Mich., it is basic to the work of toolmakers, diemakers and patternmakers. The volume covers fundamentals of arithmetic algebra, geometry, trigonometry, logarithms and the slide rule and includes many shop applications. Emphasis is on accurate computation.

Claude E. Stout is chairman of the department of mathematics and engineering mechanics at General Motors Institute.

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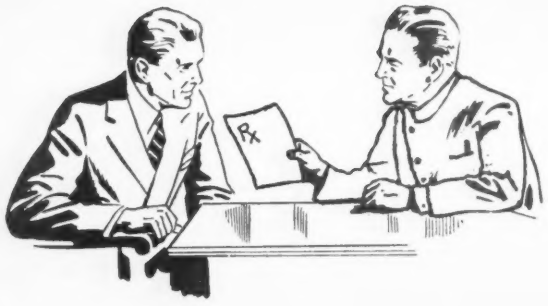

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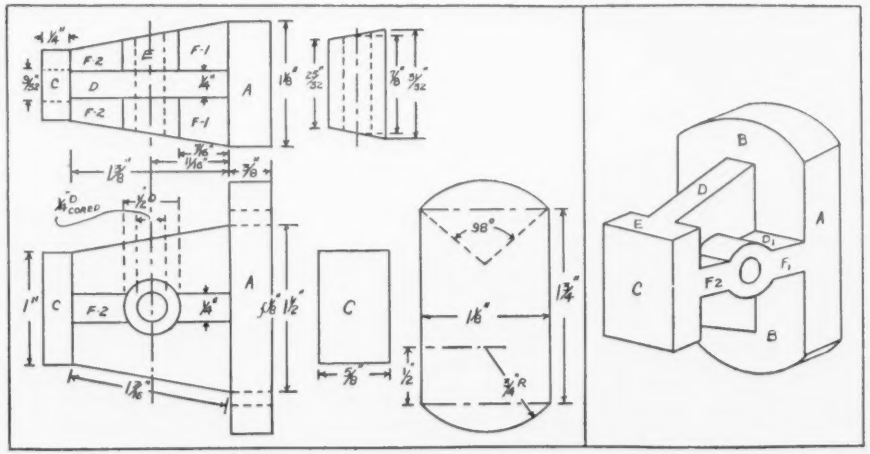
Determining Casting Weights from Blueprint Data

System is the first requisite for estimating the weights of castings from the blueprint. The many computations must be carried out as accurately as possible and with a minimum of time and effort.

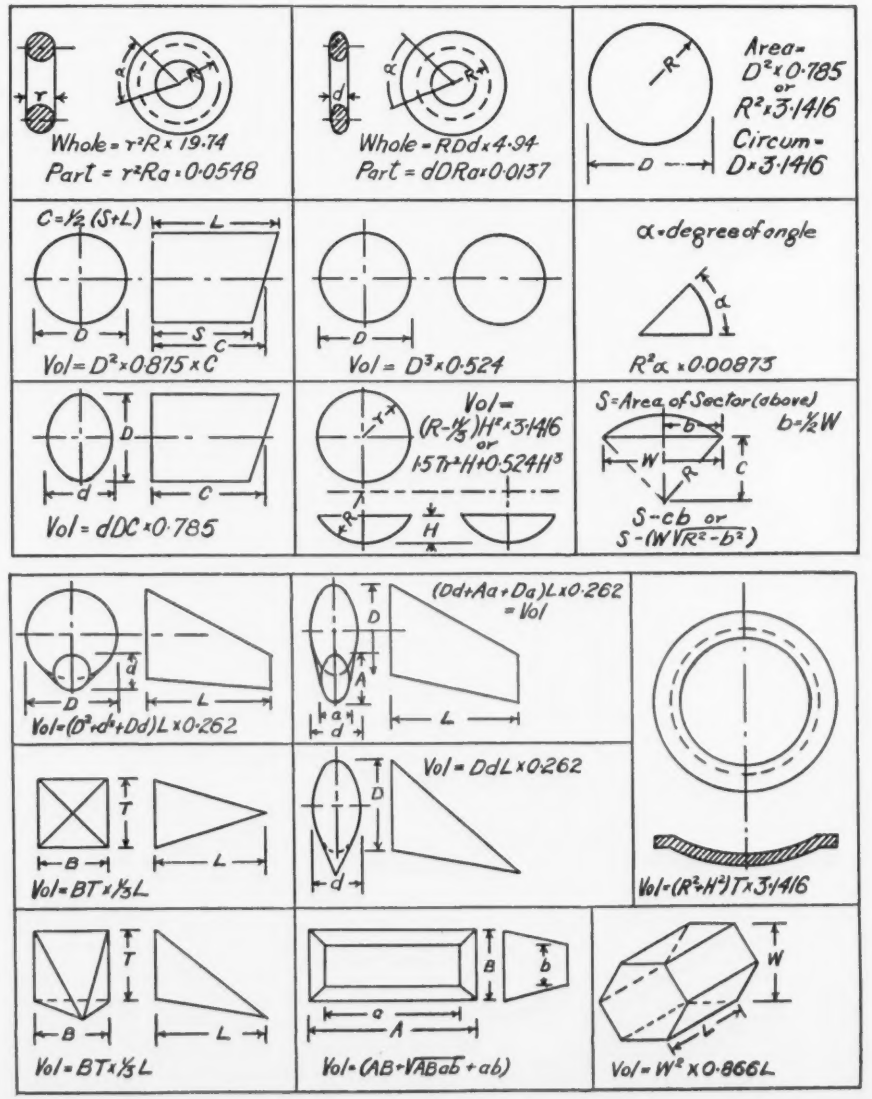
Analysis of the figuring of the small and comparatively simple casting shown in Figs. 1 and 2 indicates something like 50 separate computations and some three dozen conversions from fractions to decimals. This casting is not shown with the idea of demonstrating the solution of a difficult weight estimating job, but simply to illustrate the manner of attacking the problem.

Of course, all the dimensions shown would not appear on the blue print. On occasion the weight estimator is forced to scale the drawing. However, he should do this only after scanning the list of changes—if any—made on the print. Then he can make allowance for parts thrown out of scale and also for shrinkage entailed in the blueprinting process.

In some instances the only tool required is a pencil, but in the great majority of instances the following tools greatly facilitate the work: A triangle



Figs. 1 and 2 (Above)—Dimensional information is presented in the blue print at the left while the isometric sketch at the right indicates the appearance of the casting. Figs. 3 and 4 (Right)—Some of the formulas which may be used to determine the volumes of various shaped solids


Whole = r²R x 19.74
Part = r²Ra x 0.0548
Whole = RDd x 4.94
Part = dDRa x 0.0137
Area = D² x 0.785 or R² x 3.1416
Circum = D x 3.1416
C = ½ (S+L)
Vol = D² x 0.875 x C
Vol = D³ x 0.524
α = degree of angle
R²α x 0.00873
Vol = dDC x 0.785
Vol = (R - 1/3 H) H² x 3.1416 or 1.57r²H + 0.524H³
S = Area of Sector (above)
b = ½W
S = cb or S = (W √R² - b²)
Vol = (D² + Dd + Dd) L x 0.262
(Dd + Aa + Da) L x 0.262 = Vol
Vol = BT x ⅓ L
Vol = DdL x 0.262
Vol = (R² + H²) T x 3.1416
Vol = BT x ⅓ L
Vol = (AB + √AB ab + ab)
Vol = W² x 0.866 L

Determining Casting Weights from Blueprint Data

for drawing lines between views to help clarify the drawing, etc; a protractor for determining degrees of angles not given on the print; a slide rule. This last item is most important for speedy and accurate work. Multiplication can be made in a fraction of the time required by any other method. The cost of these tools is merely nominal and skill in their use pays large dividends.

Formulas for figuring the cubical content of various shapes are shown in Figs. 3, 4 and 5. Simple application of a few of the formulas taken from Fig. 2, are as follows. For identification and reference the various parts of the casting under discussion have been lettered: A, B, C, D_1, E, F_1 and F_2. Briefly the casting may be described as a small pedestal in which the cap and base are connected by two webs intersecting each other at right angles and with a cored boss forming the center of one of the webs.

DECIMAL EQUIVALENTS

64ths	1—.0156	3—.0469	5—.0781	7—.1094	9—.1406	11—.1719	13—.2031	15—.2344
	17—.2656	19—.2969	21—.3281	23—.3594	25—.3906	27—.4219	29—.4531	31—.4844
	33—.5156	35—.5469	37—.5781	39—.6094	41—.6406	43—.6719	45—.7031	47—.7344
	49—.7656	51—.7969	53—.8281	55—.8594	57—.8906	59—.9219	61—.9531	63—.9844
32nds	1—.0313	3—.0938	5—.1563	7—.2188	9—.2813	11—.3438	13—.4063	15—.4688
	17—.5313	19—.5938	21—.6563	23—.7188	25—.7813	27—.8438	29—.9063	31—.9688
16ths	1—.0625	3—.1875	5—.3125	7—.4375	9—.5625	11—.6875	13—.8125	15—.9375
8ths	1—.125	3—.375	5—.625	7—.875				
4ths	1—.25	2—.50	3—.75					

Section *A* is a block or slab 1⅛ x 1¾ x $\frac{7}{16}$-inches (⅜ plus $\frac{1}{16}$-inch finish). Cubical content of this section therefore is: 1.75 x 1.125 x 0.4375 = 0.862 cubic inches.

Section *B* includes the two segments at the ends of *A*. The formula for the solution of such shapes, not including the thickness is S-cb. as shown in Fig. 3: According to a formula in Fig. 2, the area of the sector is R^2 a x 0.00873. In this instance R = ¾" and a = 98 degrees, then by doubling the degrees to take care of both sectors, and including also the thickness, the formula becomes 0.75^2 x 196 degrees x 0.00873 x 0.4375 = 0.422. The product of cb x the thickness must be deducted from this total. Since b = half the width of section *A*, by webs or connecting members between the two ends, may be figured according to the formula (A plus B) ½H x the thickness as indicated in Fig. 4. In this instance A = 1 in., B = 1½ in. H = 1⅜ in. and the thickness is ¼-in. Therefore the cubical content will be secured by substituting in the formula, as follows: (1.00 + 1.50 x 0.50 x 1.375 x 0.25 = 0.430 cu in.).

Section *B*, is included in the contents of Section *E*, therefore it must be deducted from section *D*. The cubical content of a cylinder ½-in. in diameter and $\frac{8}{32}$-in. in length is as follows: 0.50^2 x 0.785 x 0.2813 = 0.055 cu in.

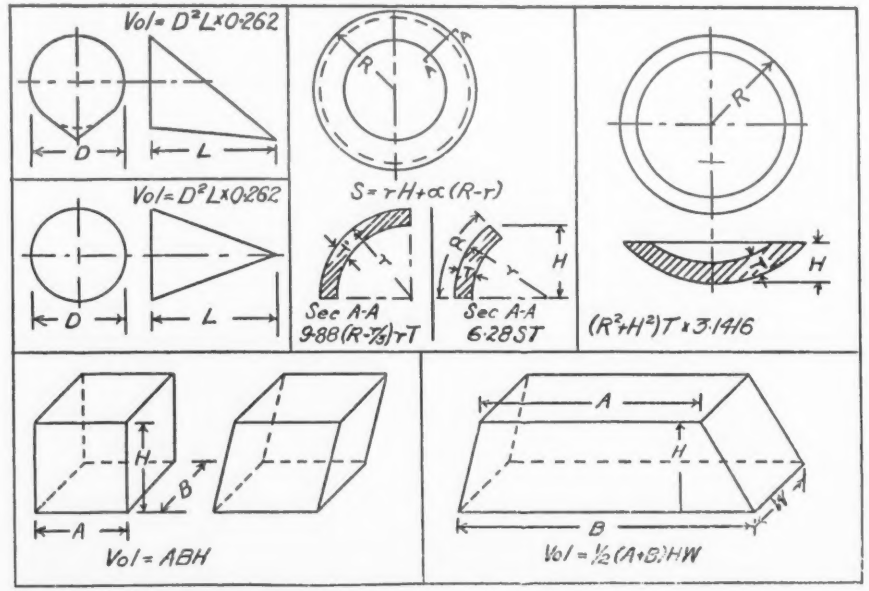


Fig. 5—Additional formulas for calculating the volumes of solids of various forms

Section *E* is a hollow cylinder ½-in. in diameter, ⅞-in. in length with a central cored hole ¼-in. in diameter. The cubical content of a cylinder equals D^2 x 0.785 x the length. The process in the present instance may be shortened by deducting the square of the inside from the square of the outside diameter. The difference between 0.50^2 and 0.25^2 = 0.1875. Therefore, the content of *E* is 0.1875 x 0.785 x 0.875 = 0.129 cu in.

(To Be Concluded)

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ACTIVITIES of Foundry Groups

Chicago: About 250 members of the AFS chapter met at the Chicago Bar Association on Nov. 7 to hear four roundtable discussions and witness the presentation of the second Robert E. Kennedy scholarship. Chapter President James T. Moore, vice president, Wells Mfg. Co., presided. (Story on scholarship award is on page 241.)

Gray Iron division heard Clarence Holmes, Citizens Gas & Coke Utility, Indianapolis, discuss "Manufacture and Application of Foundry Coke." Ford R. Snyder, vice president, Hickman, Williams & Co., was chairman. R. E. Wozniak, Chicago Lighting Institute, addressed the Maintenance division on "Are You Working in the Dark?" Chairman was Charles McDonald, master mechanic, National Malleable & Steel Castings Co.

Bradley H. Booth, foundry engineer, Carpenter Bros., Milwaukee, addressed a joint meeting of the Steel and Malleable divisions on "Foundry Sands." Donald E. Meves, research metallurgist, American Steel Foundries, presided. Nonferrous and Pattern divisions joined in considering "Permanent Molding of Aluminum Alloys" with G. L. Armstrong, chief metallurgist, U. S. Reduction Co.

Second in the series of four roundtable meetings for the 1955-56 year was held by the chapter Dec. 5, at the Chicago Bar Association. Close to 175 members and guests attended the dinner and participated in the group sessions.

In addition to introducing a number of guests from out-of-town, Chapter President Moore, gave special welcome to 18 student-members enrolled in pattern and foundry courses at Navy Pier Branch, University of Illinois.

One session, in which the Malleable and Steel Divisions collaborated, headlined Eric Welander, chief metallurgist, John Deere Malleable Works, East Moline, Ill., who spoke on "Where to Look for New Business." Paul Shirka Jr., general foreman, Crane Co., presided.

"Characteristics and Applications of Ductile Iron" was the subject which David Matter, foundry engineer, Manufacturing Research, International Harvester Co., discussed before the Gray Iron Division. H. G. Haines, metallurgist, Woodruff & Edwards Co., was technical chairman.

Robert Wright, Oliver Machinery Co., Grand Rapids, Mich., addressed the Pattern Division on "Advantages of a Wood Milling Machine in Your Pattern Shop." Serving as technical chairman was Allen Schander, Chicago Pattern & Model Works.

The Maintenance and Nonferrous Divisions joined to hear T. A. Lyon, DuBois Engineering & Mfg. Co., Hammond, Ind., explain "Foundry Heating and Ventilating." Presiding was E. Greenlees, master mechanic, Kensington Steel Co.

The chapter's next meeting, designated as Management and Past Presidents' Night, is Jan. 3. Feature speaker will be James H. Smith, general manager, Central Foundry Division, General Motors Corp., Saginaw, Mich. His subject is "Recent Developments in the Foundry."—*Erle F. Ross.*

Northeastern Ohio: More than 200 foundrymen gathered at the Tudor Arms Hotel, Cleveland, on Nov. 10 to hear C. E. Wenninger, National Engineering Co., Chicago, address the AFS chapter on "Digging into Sand Fundamentals."

Mr. Wenninger said that foundrymen must consider the physical relationships of sand components and discount some set thoughts on test properties. Tests, he stated, are for control after it has been decided that a given sand will work. A four-sieve sand with rounded grains ordinarily is preferable because it will ram compactly, but what is good for some jobs might not work as well for another job or another foundry. There is no standard sand.

In synthetic sand, it might be well to add more than enough clay and fines and to mull the mixture less. The sand thereby can hold more water. Such procedure is a trend to what natural sands are like. Some sands must be mulled, and some can be mixed. When clay is added to low-clay sand, mulling is required. Adding water too fast creates clay balls. A lubricant such as core oil can be added to facing sand to give flowability.

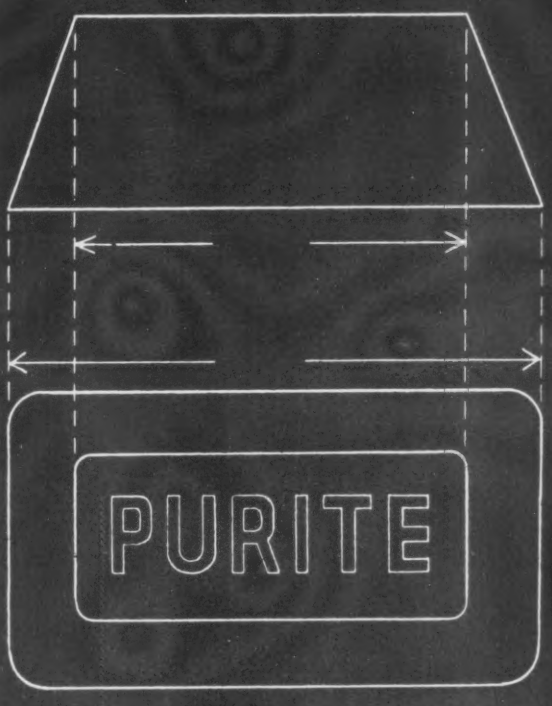
Walter H. Siebert, Cleveland Standard Pattern Works, presented an informal discussion before the Pattern-making Group on his experiences during a month's stay in England, Switzerland, Germany and Denmark. He highlighted several dozen colored slides with interesting commentary on living and working conditions in the areas he visited. John F. Roth, Cleveland Standard Pattern Works, introduced the speaker.

On Dec. 8, Northeastern Ohio Chapter held its annual Christmas party at the Hotel Carter, Cleveland. The customary 1000 foundrymen and guests were on hand to enjoy dinner and the fine program of entertainment arranged, as usual, by L. P. Robinson, Archer-Daniels-Midland Co., Cleveland.—*Jack C. Miske.*

Birmingham: Soil pipe production was under discussion at the Nov. 4 meeting at the Country Club, Anniston, Ala. A. J. Fruchtl, W. Thomas Barr Associates, presided. J. Wylie Perry, development engineer, Alabama Pipe Co., outlined the history of the soil pipe industry to set the stage for the program to follow.

The split mold (Nolan process) was discussed by T. H. Burns, assistant to the president, Central Foundry, Holt, Ala. A film of the Central operation also was shown. Leo LeBlanc, production engineer, Alabama Pipe Co., described the Herman Pneumatic sand mold process. E. E. Pollard, Tyler Pipe & Foundry Co., Tyler, Tex., spoke on methods used at his plant. D. B. Shannon, vice president, Somerville Iron Works Inc., Chattanooga, Tenn., elaborated upon the the rubber diaphragm molding meth-

NEWLY ELECTED officers of the Texas Chapter of the AFS are, left to right, Lawrence Ennis, Texas Electric Steel Castings Co., treasurer; H. J. Pfeifer, Electro Metallurgical Co., secretary; J. R. Hewitt, Texas Foundries Inc., chairman, and W. A. Bearden, M. A. Bell Co., vice chairman. Photo is through the courtesy of J. S. Ahrens, National Carbon Co.



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od and its use by his company.

In addition, the 220 members and guests present were treated to a talk and film presentation of the methods used by Akers Styckebruk Iron Works, Sweden, by O. J. Bach, vice president of that organization, who was a visitor at the meeting.—*A. B. Schwarzkopf, U. S. Pipe & Foundry Co.*

Pittsburgh: Charles E. Peterson, chief metallurgist, Mackintosh-Hemphill Division, E. W. Bliss Co., was the speaker at the Nov. 21 meeting of the Pittsburgh Foundrymen's Association. He discussed "Present Day Roll Manufacture." A movie made by Mackintosh-Hemphill showing manufacture of iron and steel rolls was presented with comments from the speaker on techniques for casting and machining rolls.

Among new developments in roll-making, the speaker evaluated modern attempts at mechanization in molding and discussed several methods of chilling rolls. There are some innovations in scrap (turnings are found to be satisfactory in furnaces), and several new improvements made in design and development of rolls. In machining rolls, trend is to bigger, heavier and faster machines.

Results of balloting on affiliation with the national society were announced as favorable to the dissolution of the independent PFA. Action toward joining the national organization will be taken at future meetings.—*Robert M. Love.*

Wisconsin: Four sectional meetings comprised the Nov. 12 program of the AFS chapter as they met at Hotel Schroeder, Milwaukee. Gray Iron and Pattern groups heard Richard I. Olson, Dike-O-Seal Inc., who talked on "Sealing Coreboxes for Blowing." H. Wesley Stokes, Kilbourn Pattern Co., served as chairman.

"Foundry Layouts and Maintenance" was the subject of L. P. Brobst, National Engineering Co., before another group of which C. A. Gutenkunst, Milwaukee Malleable & Grey Iron Works Inc., was chairman. John Nieman, Shell Process Inc., talked on "Shell Molding in the Small Foundry." Walter Puzach, Ampco Metal Inc., acted as chairman.

"New vs. Old Coreroom Practices" was discussed by Joseph A. Gitzen, Delta Oil Products Co. Paul Hiemenz, Falk Corp., was chairman.—*John E. Hubel.*

Canton: Ninety-one members and guests of the AFS chapter met at the Elks Club, Barberton, O., on Nov. 3 to hear a talk on "Ductile Iron" by Prof. Richard A. Flinn, University of Michigan. H. A. Biddinger, F. E. Myers & Bros. Co., Ashland, O., chapter chairman, presided. W. W. Snodgrass, Massillon Steel Castings Co., Massillon, O., vice chairman, introduced the speaker.

In his talk, Prof. Flinn described the engineering properties of various types of ductile iron, as well as the manufacturing processes and some of the problems encountered and their solutions in producing this material on a production basis.—*R. R. Kozinski, Canton Malleable Iron Co.*

Connecticut Non-Ferrous: "Sand Review and New Developments" was the subject of D. F. Sawtelle, metallurgist, Malleable Iron Fittings Co., Bradbury, Conn., at the Oct. 19 meeting of the Connecticut Non-Ferrous Foundrymen's Association at Quinnipiak Club, New Haven, Conn.

Mr. Sawtelle cited recent advances and improvements in sand technology, sand testing methods and equipment. Management has learned the necessity and value of sand control as well as the importance of proper supervision in the foundry. Speaker emphasized that testing equipment, like all laboratory apparatus, should be kept in good working order and standard testing methods should be employed. The understanding of the equipment and the meaning or interpretation of results should be left with a competent person or one having a proper knowledge of testing procedures.

Speaker recommended the formulation of sand to one's own specifications as no two foundries have exactly the same conditions or equipment. A study of the individual foundry and its requirements was recommended. Zircon sand and its potential for nonferrous use was mentioned. Its chilling action, ability to remove heat and eliminate shrinkage deserve attention, according to the speaker. Optimum deformation range for small brass and aluminum castings was given as 10-20 with a range of 15 to 25 for large castings.

At the Association's Nov. 16 meeting, Wesley Case, foundry superintendent, Belknap Works, Detroit Controls Corp., Bridgeport, Conn., was moderator at a roundtable discussion of questions submitted by members. Papers presented at the New England Conference of interest to nonferrous foundrymen also were discussed briefly.—*Frank B. Diana.*

"—Heard you need a sandslinger. Mom says I'm a terror at it!"

Southern California: "Patterns for High Production" was the subject of O. C. Bueg, president, Shell Castings Inc., Erie, Pa., at the Nov. 11 meeting of the AFS chapter at Rodger Young Auditorium, Los Angeles. William Mitchell, Utility Steel Foundry Co., chapter program chairman, introduced the speaker.

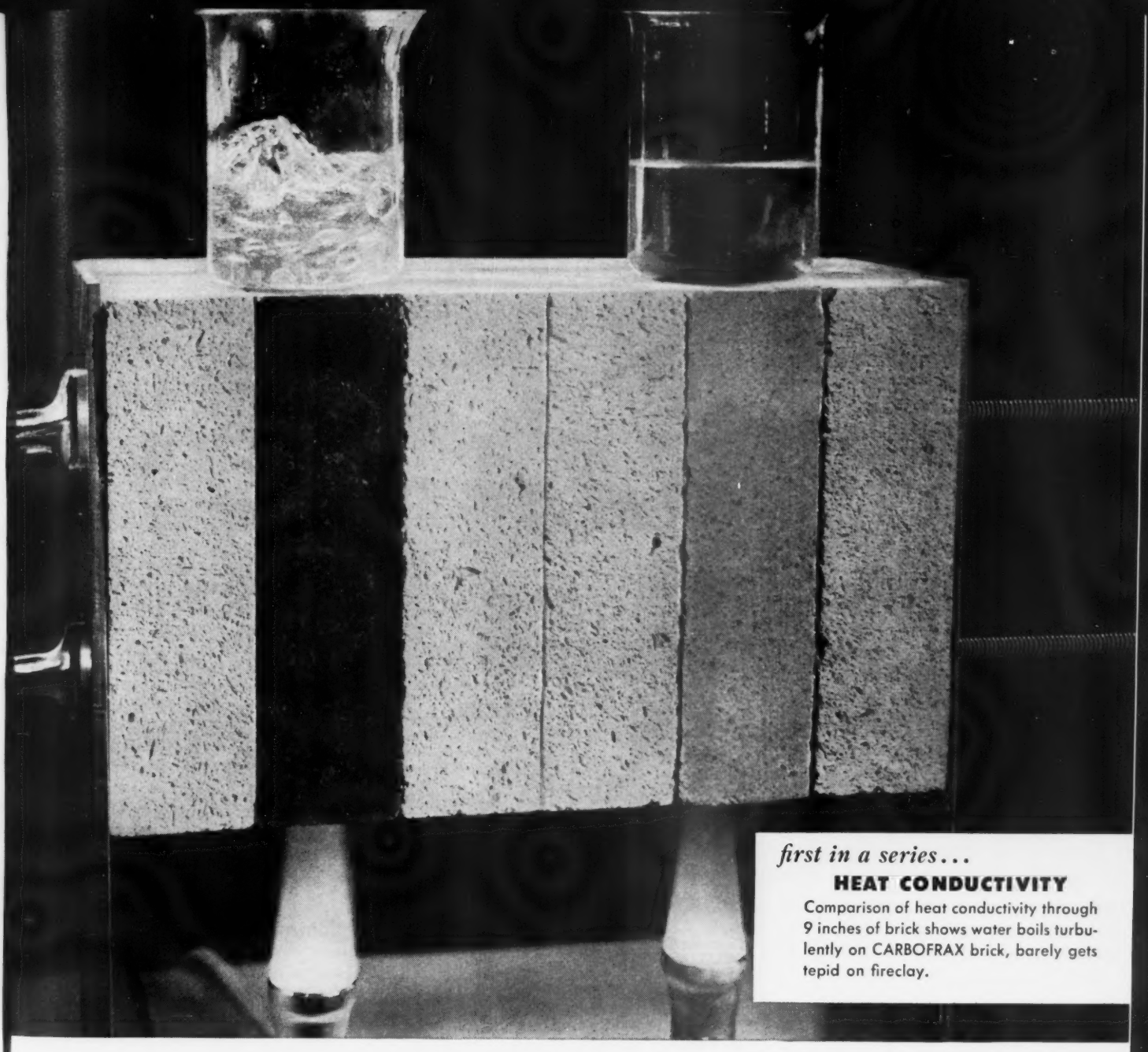
Mr. Bueg stressed the need for cooperative basic planning of pattern equipment between patternmakers and foundrymen. Manufacturers who buy pattern equipment are becoming more price conscious, according to the speaker, and patternmaking industries must develop new methods and ingenuity to conform to realistic costs. He expressed concern about the lack of apprentices in the industry. Slides were shown emphasizing construction methods of production patterns.—*Edwin J. Worth, Howell Foundry Co.*

Ontario: J. L. Carter, cost consultant, Gray Iron Founders' Society, Montclair, N. J., addressed 150 members of the AFS chapter on Nov. 18 at Hotel London, London, Ont., on "A Good Cost System—Key to Profitable Foundry Operation." F. W. Kellam, Electro Metallurgical Co. of Canada, presided. Technical chairman was J. P. Lubenkov, Link-Belt Ltd., Elmira, Ont.

Mr. Carter emphasized the importance of a cost system, the need to eliminate guess-work and the necessity to base prices on actual costs rather than on competitors' prices. A simple, basic method for estimating costs was outlined.—*Len Humphreys, A. H. Tallman Bronze Co.*

Cleveland Nonferrous: The subject of costs occupied members of the Non-Ferrous Founders' Society chapter at its monthly meeting Nov. 17 at the Cleveland Athletic Club. Walter O. Larson Jr., Grafton Foundry Co., the chapter chairman, presided.

Principal discussion centered on a proposal to organize a cost group in the Cleveland area. It would be



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similar to groups formed by the Cincinnati and Boston chapters and would permit an individual foundry to compare its operating costs in various departments with those of other foundries. This would be effected by quarterly tabulation of such data by a central agency which would be set up.

The plan was explained in detail by Martin W. O'Malley, Wellman Bronze & Aluminum Co., William A. Gluntz, Gluntz Brass & Aluminum Foundry Co., and Urban F. Von Rosen, the chapter's foundry cost consultant.—*W. G. Gude.*

Texas: Sixty-five members and guests attended the AFS chapter meeting on Oct. 28 at the Menger Hotel, San Antonio, Tex. Principal speaker was J. O. Musick, general manager, Texas Safety Association. Mr. Musick presided over a panel composed of J. P. Hunter, safety engineer, Texas Foundries Inc.; H. M. Sanders, district engineer, Employees Casualty; Baxter Grier, general superintendent, Alamo Iron Works; Sam Forsgard, personnel director, Western Foundries and Conrad Flinn, director, industrial relations, Texas Steel Co. Eye accidents, safety goggles, fatigue, back injuries, selling safety to supervisors, education and management benefits from the safety program were among the subjects discussed by the speaker and the panel.—*J. S. Ahrens, National Carbon Co.*

Central Ohio: AFS film, "A Study of Vertical Gating Design," was shown at the Oct. 10 meeting of the AFS chapter at the Seneca Hotel, Columbus, O. J. G. Kura and K. R. Grube, Battelle Memorial Institute, who were active in the research from which the film was made, discussed the film and displayed a plastic model showing proper arrangement of vertical gating design. Sound castings were produced, according to Mr. Kura, from the gating arrangement.

J. E. Gotheridge, Foundry Services Inc., Discussed the CO_2 process before the chapter at its Nov. 14 meeting at Seneca Hotel. He discussed the process in all its aspects and outlined the necessary procedures to be followed to obtain best results.—*Jose Acebo, Ohio Malleable Iron Division, Dayton Malleable Iron Co.*

San Antonio Section: Thirty-three members and guests of the AFS chapter met Nov. 21 at Alamo Iron Works, San Antonio, to see a safety film entitled, "And Then There Were Four" and to hear a lecture and demonstration of the CO_2 process by Hen-

ning B. Deiter. Refreshments were served by Kincaid-Osburn Steel Co. —*Frank A. Fournier Jr., F & J Pattern Works.*

Penn State: Student chapter of the AFS met Nov. 17 on campus at State College, Pa., and heard Charles V. Knobeloch, foundry engineer, R. Lavin & Sons, Chicago, discuss "The Melting and Refining of Brass."

Kennedy Scholarship Awarded By Chicago Chapter of AFS

Chicago Chapter of the American Foundrymen's Society on Nov. 7 awarded the second Robert E. Kennedy scholarship at the University of Illinois, Chicago Undergraduate Division, Navy Pier, to Albert G. Damico Jr., Melrose Park, Ill., a sophomore mechanical engineering student.

Present at the meeting at the Chicago Bar Association were 30 student members of the Foundry Educational Foundation enrolled at Navy Pier under the FEF program. Also present were some 20 Chicago area and Danville, Ill., foundrymen especially interested in educational activities directed toward the foundry industry.

Photo by Fred Ridenour, Whiting Corp.

John A. Rassenfoss, manager, manufacturing research laboratory, American Steel Foundries, (at right in picture) who was president of the chapter when the scholarship fund was established early in 1954, presented the award to Capt. Damico, an Air Force veteran of World War II (at left in picture).

The scholarship endowment fund is administered by the Navy Pier branch, and associate dean of engineering Fred W. Trezise was presented with a check for $1335. This represents contributions to the endowment since Mr. Kennedy's death on Aug. 7, 1955. Before his death, Mr. Kennedy witnessed the presentation of the first scholarship in November, 1954.

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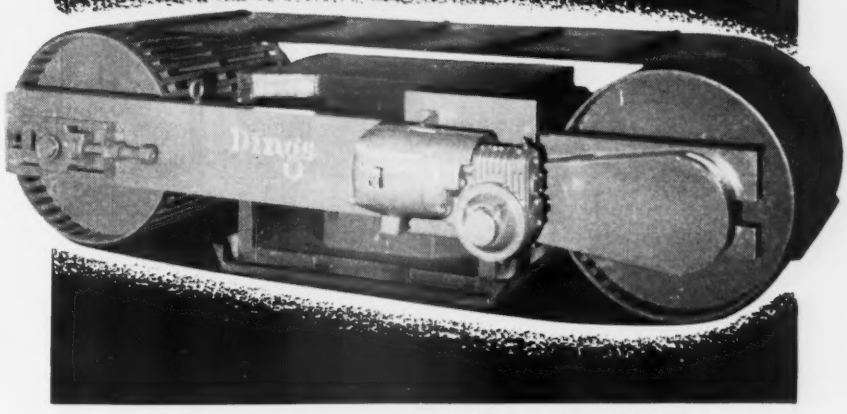

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Left to right: Frank Flory, MSU, banquet committee vice chairman; Herbert Scobie, *Modern Castings;* Hans Heine, AFS, speaker; Gardner Lloyd, Albion Malleable Iron Co., banquet committee chairman; Charles Sigerfoos, MSU, conference secretary; John Van Haver, Sealed Power Corp., conference chairman; Doarde Triponi, MSU, conference treasurer, and Fred Strieter, Dow Chemical Co., program chairman

Varied Program Features

MICHIGAN CONFERENCE

MICHIGAN'S most successful regional foundry conference drew a record 302 registrants to Kellogg Center, Michigan State University, on Dec. 1-2. It was sponsored by the university and the Michigan chapters of the AFS.

Prof. L. L. Otto, MSU Mechanical Engineering Department, welcomed the conference at the opening session under General Chairman John Van Haver, Sealed Power Corp., Muskegon, Mich. The keynote speaker was John Schneider, Ford Motor Co., Dearborn, Mich., who spoke on **Morale—The Key to Productivity.** He said that future growth of the industry will be influenced greatly by employees and their reactions. Management must be "sensitive" to the workers and their needs. However, business has grown to a size where the boss cannot be close to the men in the plant. Consequently, management must develop a program which will fill the need of the aforementioned sensitivity.

The foreman is the key to worker morale, and the management program must work through him. He should be given a manual listing his duties and responsibilities and stating company policy. He should receive daily information bulletins and attend weekly meetings with management.

By ROBERT H. HERRMANN
Associate Editor

Hans Heine, AFS, presented the first technical paper, **The Carbon Dioxide Process.** He described the process briefly, emphasizing that the proper sodium silicate should be used in sand mixtures. Different ones have varying percentages of sodium and silicate. Mr. Heine also suggested that CO_2 cores should be made in boxes having movable sections which can be drawn away from the core instead of drawing the core from the box. Also boxes should be vented properly so that CO_2 will reach all parts of the core for proper hardening.

Sodium silicate sand mixtures may be used as a facing in molds to a thickness of 2 or 3 in. Balance of the flask is filled with a low-moisture-content backing sand. The sprue, runners and ingates must be part of the pattern because the sand is hardened in place prior to pattern removal. Gating and risering techniques need not be modified.

Contamination of green sand with

Marvin Van der Ploeg, MSU senior, student essay contest winner is second from the left. He is flanked by essay committee co-chairmen Robert Dodge, Archer-Daniels-Midland Co., at left and Paul Olsen, Eaton Mfg. Co., at right. John Van Haver, general conference chairman, is at extreme right

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The foundryman unclamps the pattern plate from the dump box. Notice the thin shell of partially-cured FOUNDREZ 7500 and sand clinging to the plate.

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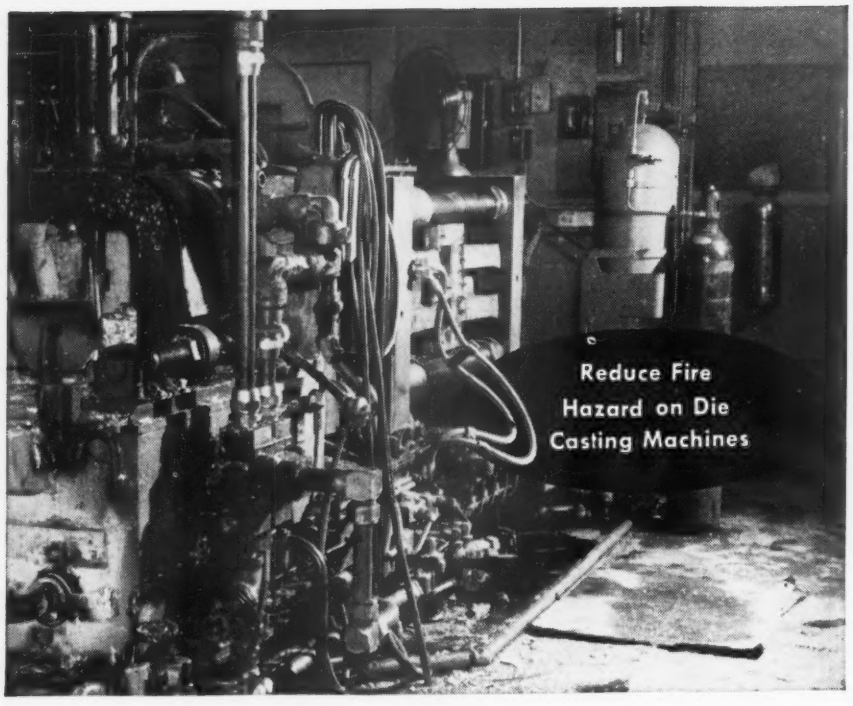

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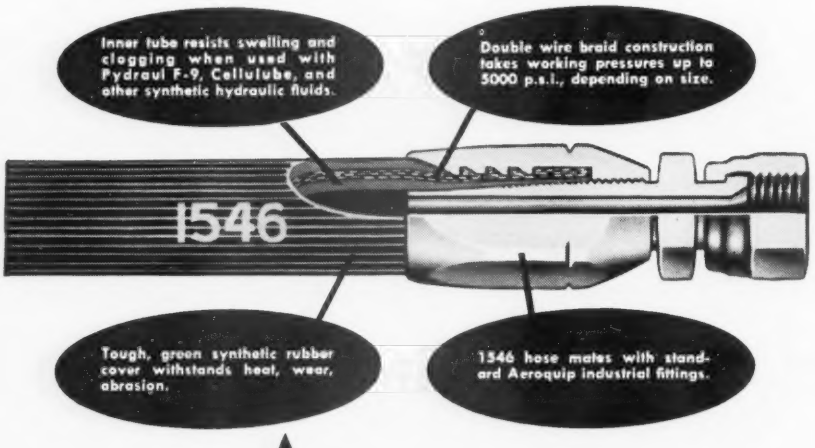
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the sodium silicate sand is a problem. The hardened sand contains soda ash which lowers the sintering point of green sand. Wet sand reclamation methods may be used to renew the sand or it can be put in the foundry yard and allowed to weather. Air and rain will leach out the soda ash.

Dr. W. W. Whitehouse, president, Albion College, addressed the first day luncheon group on **The American Adventure.** He said that youth must be taught to think and be able to recognize trends in our country's progress. They must learn not to be fooled by fog and smoke screens intended to disguise true trends. Youth needs an unrestricted atmosphere of growth, freedom and expanding frontiers.

The first afternoon session was a **Casting Defect Clinic** with Harry Gravlin Jr., Claude B. Schneible Co., Detroit, as moderator. Panel members were R. W. Gardner, Ford Motor Co.; E. J. Passman, Frederic B. Stevens Co., Detroit; Michael Warchol, Atlas Foundry Co., Detroit; Prof. Richard Flinn, University of Michigan, and Henry Laforet, Lakey Foundry Corp., Muskegon.

Mr. Gardner stressed the need for an organized, positive approach to casting quality. Such an approach requires complete records for tracing the causes of defects. Records should be in the form of charts, covering a long enough period—a week or two—so that daily fluctuations do not loom as catastrophes. The period trend is the important thing.

In discussing gas problems Prof. Flinn said that gas really is a part of metal analysis. Two general types of gas defects are: Localized defects caused by entrapment of gas in the mold, and over-all defects caused by chemical solution of gas in the metal. The former can be reduced by proper venting and the latter by controlling gas as an element in the alloy.

Mr. Passman, discussing sand defects, said that they are caused by grain distribution, organic and clay content and moisture. These affect the various sand properties, which can be changed to control casting defects. A few suggestions he made were that veining and scabs can be reduced by adding carbonaceous material to the sand. Mechanical penetration can be reduced by increasing mold hardness or by using a mold coating plus hard ramming. Pinholes can be minimized by reducing moisture and by increasing venting.

Mr. Warchol discussed metal con-

trol. Foundrymen must know the effects of alloying elements to develop the desired metal analysis. Furthermore they must understand the melting furnace and have a thorough knowledge of gating and risering techniques. The application of good metal transfer and pouring practice is the final element in good metal control.

Analyzing a job in light of foundry capabilities and the need for foundry thinking when a part is being designed were emphasized by Mr. Laforet. Type of fixtures and the proper or improper placement of a casting for shot blasting and heat treating affect casting quality. Cleaning methods can alter a casting finish obtained by particular foundry techniques. Also pushing a melting furnace too hard can change metal characteristics. In brief, he stressed good scheduling, sound practices and proper handling.

Second part of the afternoon session was devoted to **Casting Surface Smoothness—Effect of Process Variables.** Panel members were Dr. D. C. Williams, Ohio State University; E. E. Woodliff, Foundry Sand Service Engineering Co., Detroit; C. E. McQuiston, Advance Foundry Co., Dayton, O., and Mr. Passman with Prof. C. C. Sigerfoos, MSU, as moderator.

Dr. Williams reviewed the work of the AFS Sand Division Mold Surface Committee on metal penetration into cores. Results of the work indicate that for steel, ferrostatic head is the most potent factor in penetration; that a fused layer of sand adjacent to the casting surface does not prevent penetration; that cores composed of 50 per cent silica flour give smooth casting surfaces, and that low density cores reduce penetration.

For gray iron the tests show that core density is not related to penetration; that silica flour base wash eliminates penetration and that crystalline graphite base wash gives uneven results toward penetration.

Mold setups being used in current tests and a standard procedure for making such molds were covered by Mr. Woodliff. Studies are continuing on the effects of ferrostatic head, mold washes and sand grain mixtures on metal penetration.

Mr. McQuiston reported work done on distribution characteristics of sands used for certain phases of the committee's work. Statistically designed sand blends were used to study the influence of grain distribution on metal penetration. Purpose of the special blends was to overcome shortcomings of distribu-

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tions based on the AFS grain fineness number.

Mr. Passman described penetration studies with sands of different grain distributions and with various core washes. Casting surface smoothness was measured in microinches with readings from 225 to 400 being obtained. Results indicate that casting surface is improved as finer sands are used and that uncoated cores give rougher surfaces than coated cores.

In a written discussion of the papers presented, Dr. Williams said that most researchers agree that metal penetration is caused by ferrostatic head. However, he would like to know when that head becomes operative, because some technicians have said that penetration occurs after solidification. He suggested that studies be made on when penetration does occur.

Principal speaker at the conference banquet was D. B. Varner, MSU vice president. Mr. Varner outlined the university's growth since its founding in 1855 and spoke of future trends to be expected in college-level education in America.

Opening session on the second day featured G. A. Conger, C & S Products Co., Detroit, on the subject **Blowing Shell Cores and Molds.** Mr. Conger discussed cold and hot coating of sands, saying that conventional mullers can be used without major modifications. Minor alterations considered beneficial but not essential involve use of a dust hood, an exhaust hood and modification of plows and wheels. Coated sand can be stored indefinitely if kept dry and at reasonable temperature. Moisture pickup will impair blowability and produce variable sand physical properties.

Storage problems can be minimized by storing a 5 per cent resin mixture and diluting it to the desired resin level for a given job by dry blending clay-bearing sands into the mixture at the time of use.

Sands properly coated with resin have high blowability and can be blown around corners and farther than oil-sand mixes. Therefore, lower blow pressures and fewer vents and blow holes are required. In most cases coated sand can be blown at air pressures of 30 to 50 psi.

The speaker prefers shell molds made by blowing rather than by dumping. Blowing permits making contoured molds or flat backs, thus eliminating the need for pasting, fastening or shot backing because ordinary mold weights can be used, or the shells can be stacked.

The second paper, **Pressure Molding,** was presented by T. E. Barlow, Eastern Clay Products Dept., International Minerals & Chemical Corp., Chicago. Pressure molding machines utilize a rubber diaphragm to transmit full pressure of the air directly to the entire surface of sand in a flask. The rubber diaphragm follows the general contour of the pattern, giving more nearly uniform density to all faces of the mold.

Generally, the backs of diaphragm squeezed molds are contoured. If a flat back is desired, for the use of mold weights for instance, the mold can be squeezed with a false cope, which is removed after the squeeze and surplus sand struck off. Mr. Barlow cautioned against jolting the mold before squeezing because the jolt creates its own pattern of uneven sand packing and prevents the diaphragm from producing uniform mold density.

Sands for diaphragm molding should have good flowability, but otherwise are the same as conventional molding sands and can be used

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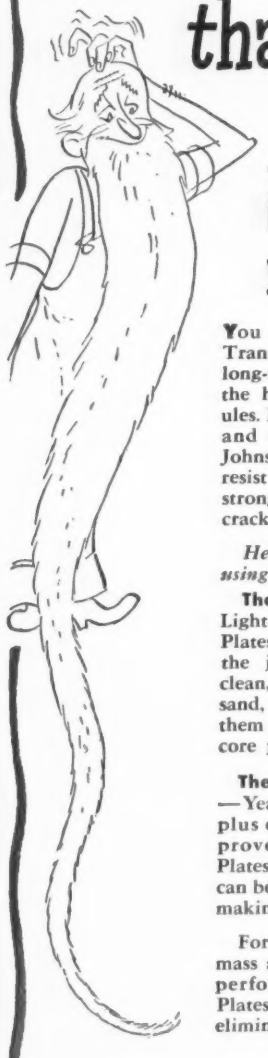

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Casting Quality Through Process Control was discussed by Dan Krause, Gray Iron Research Institute Inc., Columbus, O. He said that quality control is more than inspection; it involves much by way of process control. Its prime goal is to give the customer what he wants. Mr. Krause outlined trends in customer requirements as being good surface cleanliness, maintenance of thin, uniform machining stock and closer inventory control. Automation, which is based on continuous production flow with small or no banks of castings to feed automatic machines, requires uniform casting quality so that the machines may run continuously.

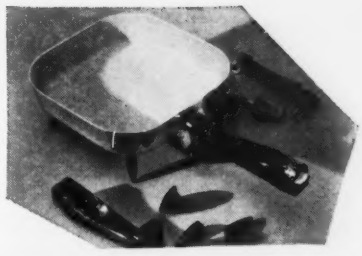
Mr. Krause went on to describe quality control practices for patterns, molding, sands, melting and inspection. He concluded by saying that record charts should be kept on all operations, and charts should be posted in foundry areas where they can be used. Also good housekeeping is a must and instills respect and confidence in workmen.

The paper, **Automatic Core Blowing,** prepared by Clifford Hockman and William Yaw, Cadillac Motor Co., Detroit, was presented by Mr. Hockman. He described coremaking operations centered around a rotary coremaking machine equipped with an automatic device for plunging a vent rod into a large core. A colored motion picture showed operation of the machine.

Hans Heine, AFS, addressed the final luncheon meeting on **Convertibles, Culture and Canards.** He pointed to the need for business men to have an interest in activities outside their jobs. The need for philosophers and theologians is as great as that for technicians. If our way of life is to continue, men must cultivate mind and spirit. In closing he pointed to the present fallacy of eulogizing the average or common man. Uncommon people, he said, are those who achieve much and are needed to fill important positions and achieve great things.

First presentation at the afternoon session was the award-winning student paper, **Investment Castings,** by Marvin Van der Ploeg, MSU senior. This was the winning paper in the first of a series of contests to be conducted each year in connection with the annual Michigan Regional Foundry Conference. It is open to all college level students attending Michigan educational institutions. Its

Shell molded fry pan has



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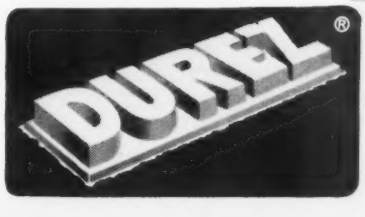

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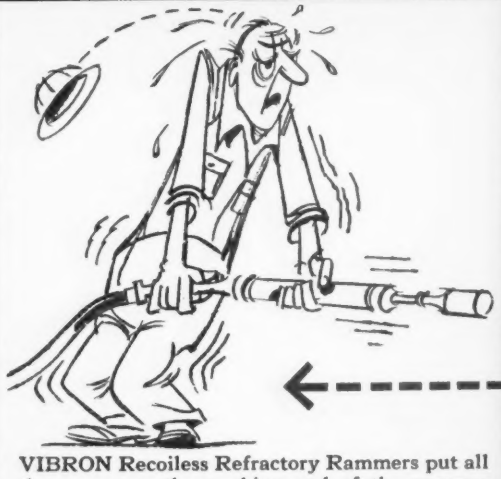

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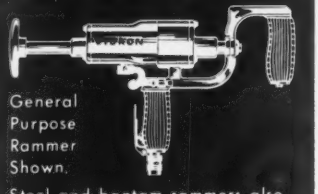

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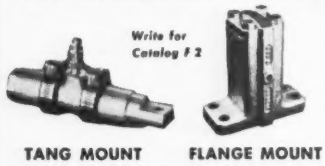

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purpose is to encourage student participation in the conferences, to acquaint them with the industry and to give them an opportunity to show foundrymen what they can do. Author of the winning papers receives $100, and judging is done by Foundry Educational Foundation personnel through E. J. Walsh, executive director.

Mr. Van der Ploeg reviewed the history and growth of investment casting, decribed the process and discussed economic factors to consider in its use compared with other casting processes. He said production of a part by the process is practicable if that part weighs less than 3 lb, is less than 5 x 6 in. in size, requires a tolerance of ±0.005 in. and would require five or more fabricating steps by another production method.

The concluding paper, **Intermediate Strength Iron,** was given by Prof. Richard Schneidewind, University of Michigan. He defined such irons as those which produce castings stronger than would be estimated from their weight and section thickness. Tensile strength ranges from 35,000 to 50,000 psi in the unalloyed metal. He also pointed to a relationship between tensile strength and hardness in ferrous metals; as hardness goes up, tensile goes up but at different percentages for different metals.

Alloying, ladle inoculation and chilling are techniques which may be used to upgrade irons. The use of permanent molds is a true method of upgrading because it produces ferrite in the metal matrix.

He went on to discuss calcium carbide injection of iron and treatment with magnesium and rare earth oxides. The resultant strengths of several experimental irons were compared.

Two films, **Vertical Gating** and **Carbon Dioxide and Core Shooting Process,** were shown following presentation of the final paper.

Awards Research Fellowship

International Nickel Co., New York, has established a research fellowship at the University of Michigan which has been awarded to Charles M. Hammond. Mr. Hammond, a graduate of the university, holds a master's degree in metallurgical engineering and a bachelor's degree in chemical and metallurgical engineering. His fellowship work concerns the effect of alloying elements on microstructures and stress rupture properties of nickel-base alloys.

TRADE . . Publications

For More Details Use Reply Card—Page 177

STEEL GRIT: Wheelabrator Corp., 505 South Byrkit St., Mishawaka, Ind.—Features and general information on heat treated high-carbon steel grit for blast cleaning are contained in Bulletin 901D.
For More Details Circle No. 141—Page 177

ENGINEERING SERVICE: Teller Co., Group P, Butler, Pa.—"Guide for Selecting An Engineering Firm" is written for those responsible for their firm's entering new product fields, for plant automation, modernization or expansion. Machine design and fabrication, equipment layout, procurement, installation, training of operating personnel and general consulting services are described.
For More Details Circle No. 142—Page 177

BLOCK MIX: J. H. France Refractories Co., Snow Shoe, Pa.—Bulletin 215 covers ten features of a castable block mix for service in annealing pit covers, arches for insulation, boiler top decks, breeching linings, door linings and duct linings. Linear change and temperature tables and a thermal conductivity graph also are included.
For More Details Circle No. 143—Page 177

TEMPERATURE CONTROL: Burling Instrument Co., 16 River Rd., Chatham, N. J.—Illustrations, description of operation, general specifications and selection chart of line of differential expansion temperature controls are contained in catalog G-20.
For More Details Circle No. 144—Page 177

SHELL CORES: Shallway Corp., Connellsville, Pa.—Bulletin 307 illustrates typical shell cores ranging from 1 to 52 in. in overall length and from 1 oz to 5½ lb in weight made by foundries using company's coreblower.
For More Details Circle No. 145—Page 177

MOISTURE - VAPOR CHART: Hankinson Corp., 540 Biltmore Bldg., 951 Banksville Rd., Pittsburgh 16, Pa.—Moisture-vapor content chart which enables evaluation of the water vapor in a compressed air system is included in bulletin M-7155.
For More Details Circle No. 146—Page 177

PRICE LIST: American Agile Corp., P. O. Box 168, Bedford, O.—Revised price list covers line of plastic laboratory ware, tanks, fume hoods, ventilating exhaust fans, ducts, pipe fittings, valves, sheets, rods and bars and blocks.
For More Details Circle No. 147—Page 177

TESTING MACHINES: Tinius Olsen Testing Machine Co., 5137 Easton Rd., Willow Grove, Pa.—Special 75th anniversary issue of

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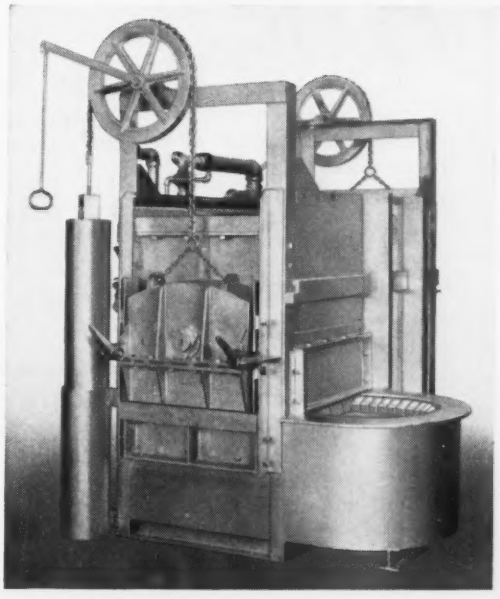

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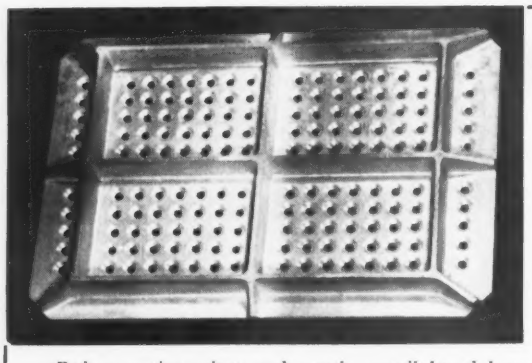

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"Tinius Talks" traces development of modern testing machines. Major advances in design of testing and balancing equipment are described as a background for the understanding of present and future developments in the testing industry.
For More Details Circle No. 148—Page 177

DUST AND VAPOR COLLECTORS: Aget Mfg. Co., Adrian, Mich.—Bulletins 636-3 and 622-3 offer engineering information on control, installation, operation and maintenance of dust collecting and vapor collecting equipment, respectively. Forty models are available to collect almost every type of dirt, dust, sawdust, lint, shavings, mist, fog or vapor.
For More Details Circle No. 149—Page 177

DIAMOND TOOLS: Diamond Products Inc., 346 Prospect Ave., Elyria, O.—Catalog offers illustrations and tool specifications covering tool dressers, thread cutting dressers and center cones, ranging from single and multiple point tools to diamond-impregnated types. Information on wheel dressing and tool reconditioning methods is included.
For More Details Circle No. 150—Page 177

PYROMETER: Photoswitch Division, Electronics Corp. of America, 77 Broadway, Cambridge 42, Mass.—Illustrated bulletin PT 556 contains descriptive data, specifications and dimensions on photoelectric pyrometer which operates over a range from 1000° to 5000°F and will respond to temperature changes of 5°F.
For More Details Circle No. 151—Page 177

POWER POSITIONERS: Hagan Corp., 323 Fourth Ave., Pittsburgh 30, Pa. Bulletin TP-MFI contains six specification sheet forms describing performance and construction features of company's standard pneumatic power positioners.
For More Details Circle No. 152—Page 177

HEAT MACHINES: Fageol Heat Machine Division, R. D. Fageol Co., Kent, O.—Bulletin LL-2220 presents specifications and application data on two heat machines of 168,000 and 189,000 Btu output per hr.
For More Details Circle No. 153—Page 177

MAGNETIC DRUMS: Homer Mfg. Co., Lima, O.—Applications and features of permanent magnetic drums for removing tramp iron or ferrous material from gravity or conveyor transported products are described in bulletin MD-200.
For More Details Circle No. 154—Page 177

WOODWORKING EQUIPMENT: DeWalt Inc., Lancaster, Pa.—Catalog SP-58-55 describes line of radial arm type woodworking machines incorporating major design changes and accessories.
For More Details Circle No. 155—Page 177

INDUSTRIAL EQUIPMENT: Syntron Co., Homer City, Pa.—Catalog 5510 contains technical data, brief de-

scriptions and photographs of vibratory equipment, feeders, conveyors, power tools, shaft seals, selenium rectifiers, diesel pile hammers, hammer drills, electric hammers and materials handling equipment.
For More Details Circle No. 156—Page 177

HOSE COUPLINGS: Titeflex Inc., 10 Hendee St., Springfield 4, Mass.—Design and construction features, selection tables, cut-away views and ordering information on line of quick connect-disconnect hose couplings are offered in catalog 7-55-20.
For More Details Circle No. 157—Page 177

BAND SAWS: Wells Mfg. Corp., 310 Service Rd., Three Rivers, Mich.—Descriptive data and specifications for line of metal-cutting band saws from 3½ x 6 in. up to 12 x 16 in. are offered in catalog G-55. A blade and speed selection chart is included.
For More Details Circle No. 158—Page 177

ELECTRIC BRAKES: Warner Electric & Clutch Co., Beloit, Wis.—Form WEB 6194 LO-M pictures and describes 21 ways in which electric brakes and clutches can be applied to power transmission drives.
For More Details Circle No. 159—Page 177

CRANE CONTROLS: Ederer Engineering Co., 2931 First Ave. South, Seattle 4, Wash.—Advantages of modernizing cranes through engineered electrical control systems are highlighted in bulletin CE-400.
For More Details Circle No. 160—Page 177

SPEED REDUCERS: Cleveland Worm & Gear Co., 3293 East 80th St., Cleveland 4, O.—Brochure contains six applications where worm gear drives and speed reducers have served industry for extended periods.
For More Details Circle No. 161—Page 177

FOUNDRY reprints

Shell Molding at Lynchburg by Robert H. Herrmann highlights one of the first foundries designed, built and operated solely to produce shell mold castings. It is a mechanized, high-production, jobbing shop making gray and ductile iron cast parts.
For a Free Copy Circle No. 180—Page 177

Close Control Pays Off in Aluminum Foundry Operations by Edwin Bremer emphasizes how careful control of all operations in producing aluminum alloy castings has paid big dividends to a small foundry. All cores and core molds are made with a newly developed liquid acrylic type resin.
For a Free Copy Circle No. 181—Page 177

How to Modernize Your Foundry by Lester B. Knight explains how judicious spending to keep plants modern and to permit the worker to produce the most for his efforts can increase quality, production, wages and profits.
For a Free Copy Circle No. 182—Page 177

Books Cover Film Strips and Photo Service Departments

Eastman Kodak Co. has issued a data book designed to help the industrial photographer carry out the necessary steps in transforming flat copy and photographs to a filmstrip or slide sequence. Titled *Photographic Production of Slides and Film Strips*, the book will enable photographers to supplement the slides and filmstrips prepared by commercial producers with presentations planned to fit a particular program for their own firm or association.

Procedures and techniques are listed to make possible the production of such presentations in small quantities at relatively low cost with conventional photographic equipment.

The company's industrial data book series has been supplemented by a book dealing with two general problems in industrial photography—starting a photographic service department and operating one efficiently after its establishment.

The 60-page book, *How to Organize and Operate Photographic Service Departments*, discusses the practical approach to the photographic service department problem with emphasis upon facilities, organization and administration. Space requirements, functions, camera equipment, personnel, position in parent organization, department accounting, pricing and equipment amortizing are treated at length.

Copies of the books are available through Kodak dealers at 50 cents each.

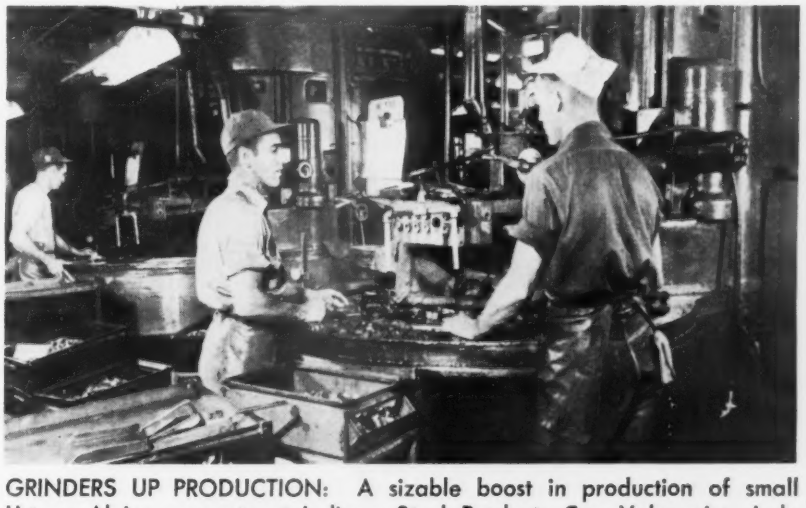
Gray Iron Management Group Picks Officers at Chicago

Chester R. Lindgren, president, Lindgren Foundry Co., Batavia, Ill., is the new chairman of the Chicago Area Management Group of the Gray Iron Founders' Society. He succeeds John M. Gajentan Jr., vice president, Chicago Foundry Co., in the post.

New vice chairman is Walden G. Greenlee, president. Greenlee Foundry Co., and new secretary is C. B. Adams, secretary, Vulcan Iron Works Inc., both of Chicago.

These officers for the coming year were elected at the group's quarterly meeting Nov. 29 at the Gramere Hotel. Chairman Gajentan presided. E. Harold Mitchell, field director of the national society, Cleveland, outlined the organization's program which is being expanded to include market research, product development and closer contacts with members of the society.

Mr. Mitchell also discussed the mounting concern of foundrymen, as well as steelmakers, over the rising price and growing shortage of iron and steel scrap. Along with other trade groups faced with this problem, the society has protested to the federal government against the large tonnage of scrap being shipped overseas under export permit.



GRINDERS UP PRODUCTION: A sizable boost in production of small U-type Alnico magnets at Indiana Steel Products Co., Valparaiso, Ind., is credited to an increased grinding rate made possible by the automatic clamping feature of vertical spindle wet-type grinders made by Besly-Welles Corp., Beloit, Wis. Magnet castings are loaded on a 48-in. diam rotary feed wheel, automatically clamped in place and revolved beneath a 36-in. diam resinoid bonded grinding wheel. One side is ground, the magnets are turned over manually, and the second face is ground. Both the squareness and the height are brought to close limits in this operation

The Shakeout

Induction Heater Hardens Gray Iron Castings

A SINGLE General Electric 20-kw induction heater helps the East Spartanburg, S. C., division of Draper Corp. precision harden over 40 different gray iron parts. Before introduction of the electronic induction heater, Draper had difficulty controlling the hardening of its wide variety of cast parts.

Hardening formerly was accomplished by chills in

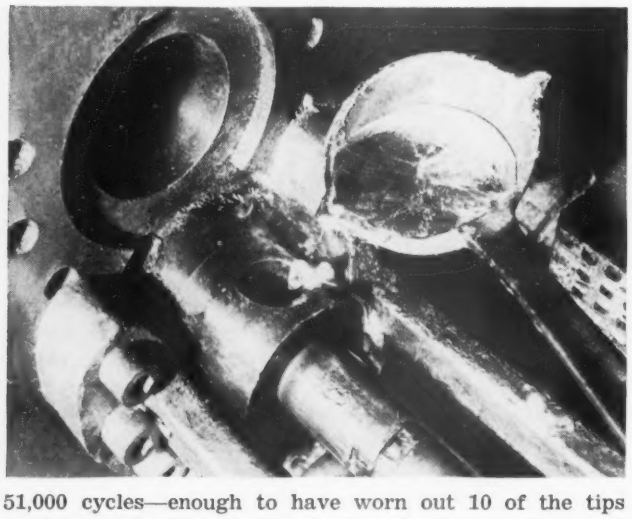
molds, but a high percentage of castings was rejected because of improper cooling and resultant embrittlement. Frequent overhardening also resulted from inadequate temperature control and hampered drilling and tapping.

With the induction heater, Draper is able to cast parts, drill and tap while the iron is soft, then harden a selected area of the casting. Rejects are eliminated, and product quality is uniform.

For More Details Circle No. 177—Page 177

Die Casting Machine Plunger Tip Lasts Longer

A BERYLLIUM-COPPER plunger tip on a 450-ton cold-chamber die casting machine at Ohio Die Casting Co., Columbus, O., still is in good condition after more than



51,000 cycles—enough to have worn out 10 of the tips used formerly. The tip is 4 in. long by 2 in. in diam and is made of Berylco No. 10 alloy, supplied by Beryllium Corp., Reading, Pa.

The Ohio foundry uses it for such jobs as forming locknuts for the plumbing industry at the rate of 150 to 160 cycles per hour. The plunger tip operates in a sleeve and forces 20-oz shots of hot aluminum into a die which forms 12 nuts per shot. In the accompanying illustration, 1200°F aluminum is being poured into the orifice of the sleeve, into which the tip fits with 0.005-in. clearance.

For More Details Circle No. 178—Page 177

Cold-Setting Binder Is New Development

HARD, nondeforming, finished cores and molds surfaces are reportedly produced when a Swiss-developed cold-setting binder is added to sands in percentages up to 2 per cent. A formulation of oils, it is said to eliminate the need for ramming, to reduce rodding by 50 to 60 per cent, to maintain accurate core sizes, to eliminate

rough-cleaning time, to produce uniformly hard core surfaces and to reduce time of baking. Working techniques for its use were developed by G. E. Smith Inc., Pittsburgh.

For More Details Circle No. 179—Page 177

Copier Speeds Duplication of Graphs and Charts

PHOTOCOPYING TECHNIQUES are being used by the Malleable Founders' Society in its Cleveland laboratory to speed the copying of graphs and charts. Society committees meet throughout the year to discuss progress being made in research, quality control and promotion, and graphic material for these meetings often is prepared on the Eastman Kodak Co. Verifax Copier shown at right. Use of the unit saves time and expense formerly required when such material had to be sent out to an outside agency for duplication.

For More Details Circle No. 180—Page 177

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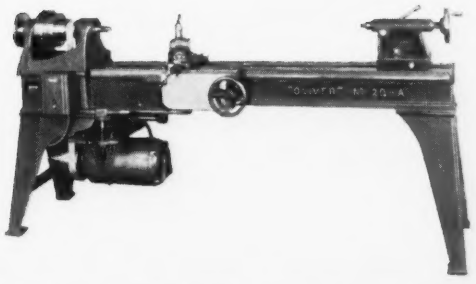

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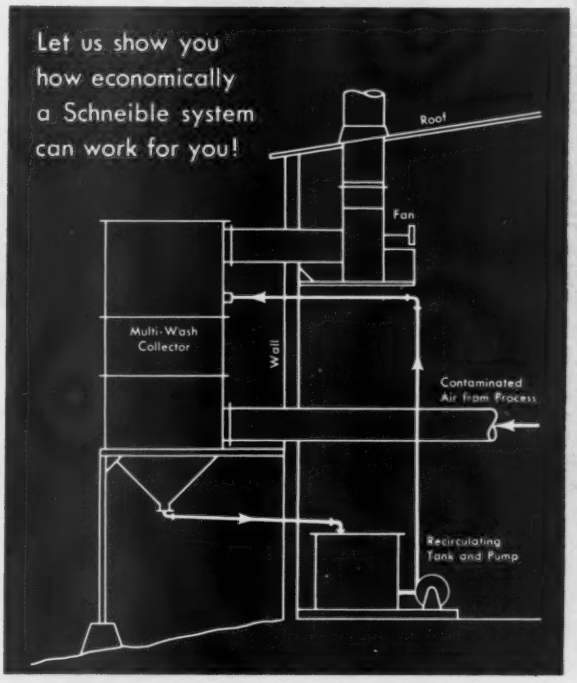

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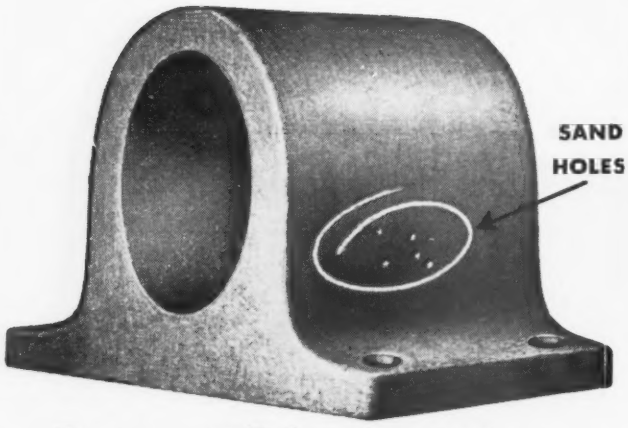

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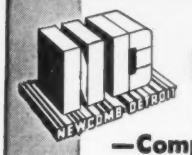

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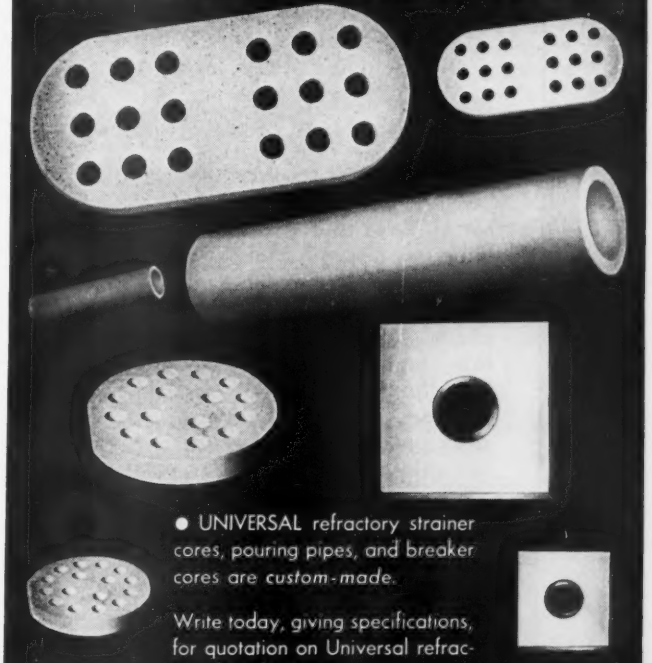

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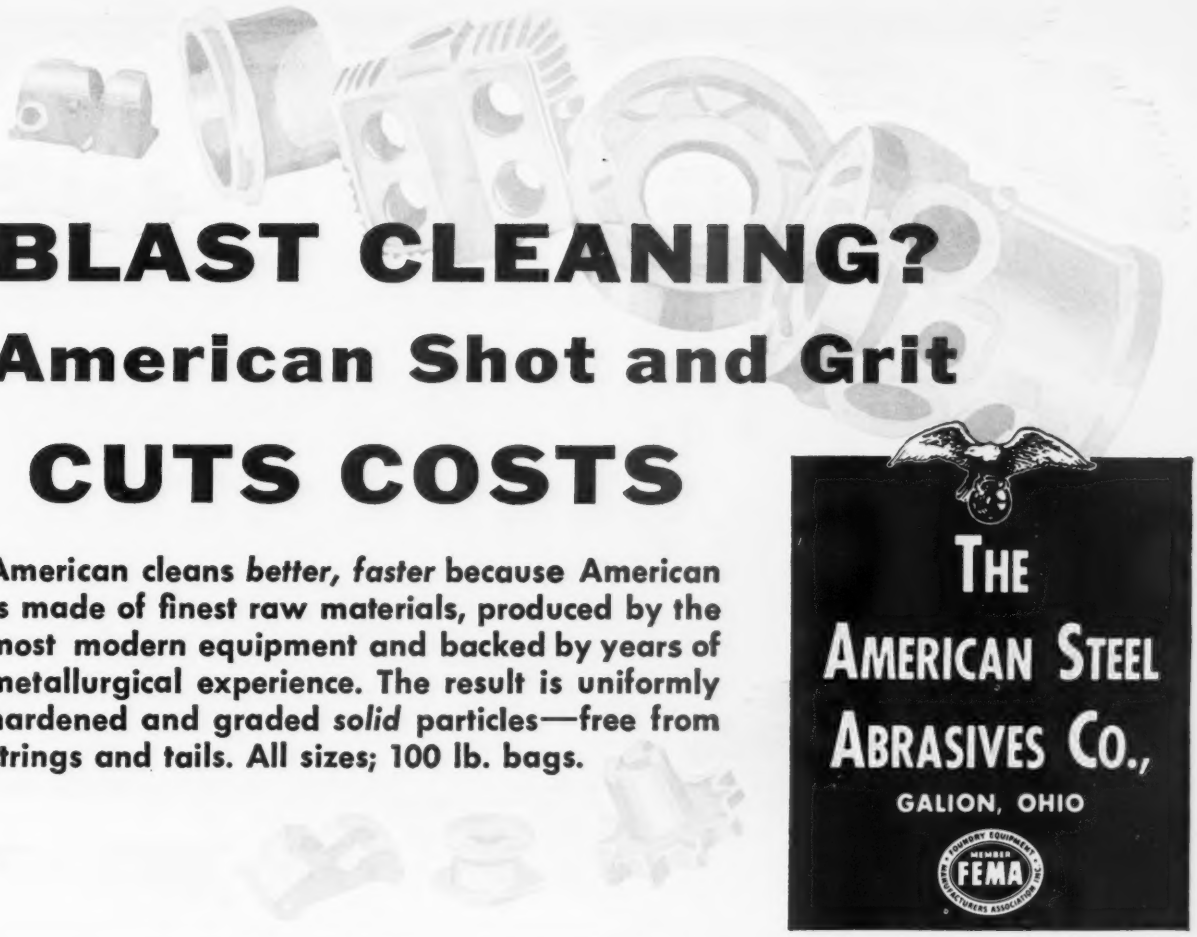

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American cleans *better, faster* because American is made of finest raw materials, produced by the most modern equipment and backed by years of metallurgical experience. The result is uniformly hardened and graded *solid* particles—free from strings and tails. All sizes; 100 lb. bags.

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WHAT DO YOU NEED IN A COST METHOD

The simplest and most complete method of costing ever prepared for nonferrous foundries is found in

BASIC COST PRINCIPLES FOR NON-FERROUS FOUNDRIES
(Non-Ferrous Founders' Society Publication)

Up-to-the-minute guide for costing in both small and large foundries. Prepared by practical foundrymen, based on 10 years of research and experience of the industry under Government Pricing Regulations.

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CORE WORK, SAND FACINGS, SPRAYS

Write for pamphlets giving detailed information. Both materials carried in stock by America's foremost foundry jobbers

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Utilizes low cost permanent molds of available steel tubing to produce gray machinable cast iron or bronze bushings. Water cooled molds can be maintained at either high or low temperature easily. High or limited production in very small space with unskilled labor. Completely safe for workmen. Simple, sturdy equipment. Quick changeover from one mold to another. Practically 100% metal yield of high quality, denser castings. Metal porosity eliminated.
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We have available an Experimental Foundry equipped for ferrous and non-ferrous melting for both vertical and horizontal centrifugal casting production. Our facilities are available to foundries for research or trial centrifugal castings at low cost.

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For all annealing and heat treating requirements
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Memo to foundry superintendents:

Edco Dowmetal Bottom Boards—
have proven again and again that
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Write or call for price schedule and list.
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Use COLOR

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Modern foundries have found it practical to color their various grades of core sands. This eliminates guesswork and assures the proper use of the required type of core sand for the particular job at hand.

Our laboratories have developed a line of special dyes in a range of colors which have been carefully tested and found both suitable and economical, for this purpose.

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Handling costs average 30% of total manufacturing cost in most industries today! To meet current competitive conditions, manufacturers are analyzing their handling operations to cut costs wherever possible. Almost without exception, the answer to the problem is found through the use of automated production handling equipment.

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For non-ferrous, cast iron and alloy steel tooling, patterns and production to close tolerances.

Use it for radial drilling in addition to vertical milling, universal milling and boring up to 11⅞".

- Column swivels 180° in either direction
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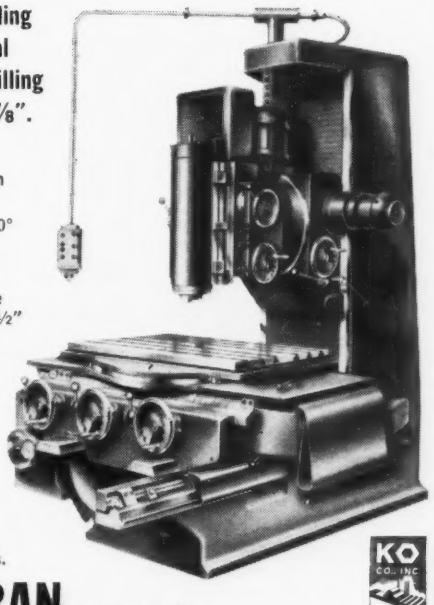

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THE TABOR MAN

The Tabor Man is a Technical Man. He is not an "order-taker", nor one who has no sand in his shoes. He knows the foundry business, and the answers to most of the problems which arise in this complex industry. He recognizes signs of obsolescence in foundry operations, and can prescribe intelligently to combat them. He knows how, when and where to modernize, mechanize, or install automation. He is able to weigh the economics of systems and procedures in the light of production schedules. And he knows that you can often buy a machine and borrow a big headache at the same time.

The services of the Tabor Man — the Trained Man — are available to you, without any obligation at all. Take the Tabor Test at the right, and see if his counsel and guidance would be helpful.

THE TABOR MANUFACTURING CO.
Lansdale, Pa.
Division of Turbo Machine Company

TABOR

TM

IS A TECHNICAL MAN

TAKE THIS TABOR TEST

Think carefully about these questions — in terms of *your own operations*. Then answer the questions objectively TRUE or FALSE. If you have 5 TRUE answers you can count yourself in very good shape. One answer in the FALSE column means that you might well take a fresh look at your operations — because these 5 M's are the bench-marks of profitable foundry practice.

	T	F
MACHINES My foundry machines work at optimum rates. They show no signs of obsolescence	☐	☐
METHODS My foundry methods can't be improved. There are no antiquated practices or tradition at work in my plant. And setting cores, pouring, cooling, shakeout and disposition of castings are no problem in my plant . .	☐	☐
MEN My men are as productive as it is possible to make them. There is no waste manpower	☐	☐
MATERIALS The materials used in my foundry are the best and most modern available. I can see no reason to change them.	☐	☐
MECHANIZATION I can't see this mechanization business. I don't see how I can increase productivity by substituting mechanical devices for some manual operations	☐	☐

The Tabor Man would be happy to discuss your foundry operations with you. This can be as brief as you want it to be, and there's obviously no obligation of any sort. Why not save yourself time and trouble by getting in touch with us?

CLASSIFIED ADVERTISING

Help Wanted

FOUNDRY RESEARCH METALLURGIST

Experienced in basic electric and Open Hearth practice, carbon and low alloy steels. Position permanent and now open. Give complete information in first letter. Must furnish acceptable references. Information will be held in strict confidence by a single executive.

BOX 813, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOUNDRY ASSISTANT

Foundry Assistant needed by captive Bronze and Aluminum foundry. Prefer experience in Bronze and Aluminum tablets, memorials and commercial castings, must have experience in plant efficiency, planning, research and operation. Age 30 to 35, with approximately 12 to 15 years' experience.

Salary open and commensurate with qualifications. Good opportunity for the right man.

Give personal history, experience, reference and salary expected.

BOX 798, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

CORE ROOM FOREMAN

A middle west malleable foundry needs an experienced foreman for core room. Primarily small cores made by female workers. Most modern equipment. Give age, salary requirements, complete history of experience and past employment and references. Confidential.

BOX 783, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

PRODUCTION FOREMAN

Large malleable foundry has opening for production foreman thoroughly familiar with molding of malleable castings. Send resume of experience and salary desired. All replies held confidential.

BOX 709, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOUNDRY ASSISTANT

Foundry assistant needed by captive gray iron foundry of medium size heavy process machinery manufacturer. Young college engineer graduate preferred. Should have had some foundry experience. Is to help increase plant efficiency, planning, research and operation. Company has liberal profit sharing plan. Salary open. Location S.E. Pennsylvania. Address: Box 713, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

Want capable gray iron foundryman with understanding of iron, sand and molding, machine and floor type work. Should possess good supervisory qualities. Give age, complete job history and salary expected. All replies confidential. Address: Box 786, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

WANTED

Man experienced in all phases of foundry practice. Capable of taking charge of a large ferrous foundry as general superintendent. Man with steel experience preferred. Address: Box 745, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MELTING FOREMAN

FOR MECHANIZED GRAY IRON FOUNDRY.

New England Foundry needs experienced gray iron man, to supervise cupola operation, assume responsibility for inoculants and alloy additions and run routine foundry tests.

Excellent opportunity for ambitious young man. Submit full particulars and experience, references and present situation in reply.

BOX 821, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

SAND MAN

Large malleable foundry has opening for man thoroughly familiar with molding sands to take complete charge of synthetic sand system.

BOX 795, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

HELP WANTED

We desire to set up our production of small steel castings on a piece-work basis instead of hourly rates. We need the services of someone who is thoroughly familiar with such an operation, capable of installing this system in our foundry. Salary open. All replies confidential. Address: P.O. Box 13294, Houston, Texas.

FOUNDRY FOREMAN

For brass production shop specializing in lightweight castings. Background in melting essential. Submit qualifications and personal background. Address: Box 809, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

METALLURGIST

Technically trained with malleable experience for well established progressive, jobbing and semi-production foundry in middlewest employing 150 men. Capable of supervising batch type air furnace melting, annealing and laboratories. Submit application including personal data, resume of qualifications and experience, references and salary expected. Address: Box 823, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MOLDING FOREMAN

For Eastern Nonferrous jobbing foundry specializing in Bronze Alloys and Aluminum. Either salary or substantial hourly rate. One who can take a job and see it through to completion with minimum effort. Write giving personal history, references and salary or rate desired. Our own men know of this advertisement. Address: Box 816, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

HELP WANTED

Foundry engineer age 28-35 experience in time study, core shop practice and sand control for large mechanized eastern foundry. Address: Box 762, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

Help Wanted

FOUNDRY METALLURGIST

For development work in Nodular Iron. Experience in Metallography and Heat Treating required. Please send resume of experience. Replies Confidential.

BOX 824, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

DESIGNERS—DRAFTSMEN—ENGINEERS

Experienced in foundry layouts and equipment. Age 30-45. Send experience record, personal data, recent photo and references.

BOX 730, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

ENGINEER INDUSTRIAL

Experience in heavy gray iron. Large Connecticut foundry. Capable of establishing new basic time standards. Also analyze foundry operations for cost reduction. Indicate experience and salary requirements.

BOX 781, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

METALLURGIST

Must have magnesium or aluminum experience. Majority of time will be spent on production problems which will consist of improving the procedure on established jobs and the rigging of new work. Remainder of time will be spent on development and research.

Mr. J. S. Wickham
WELLMAN BRONZE & ALUMINUM CO.
2525 EAST 93rd ST.
CLEVELAND 4, OHIO

FOUNDRY SUPERINTENDENT

For medium-sized gray iron non-mechanized production foundry in Minnesota. Must be thoroughly experienced in all phases of foundry techniques and production methods. Excellent future for experienced man capable of handling personnel. Preferred age 35-45 years. Send personal description, experience, history, references and photograph. Address: Box 818, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

WANTED

Man experienced in all phases of foundry practice. Capable of taking charge of medium sized steel foundry in Ohio as foundry superintendent. Address: Box 807, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

Steel Casting Jobbing Foundry located in Western Pennsylvania producing medium and light castings of Carbon and Alloy Steel. We are interested only in fully experienced foundryman having qualifications to take complete charge of operations in absence of Foundry Manager. Send resume of experience and salary desired. All replies held confidential. Address: Box 805, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY SUPERVISOR

Progressive manufacturer of gray and alloy iron castings in central Ohio needs additional supervision in molding division. Experience in floor molding with sand-slinger preferred. Excellent opportunity for right person. All replies answered and condifential. Write stating full qualifications and salary requirements. Address: Box 822, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

CLASSIFIED ADVERTISING

Help Wanted

ASSISTANT MOLDING FOREMAN

West Coast Steel Foundry has opening for well qualified man. Give personal history, references and salary expected. We are a well established company.

BOX 815, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

METALLURGIST

For mechanizezd gray iron foundry located Northern Indiana. Experience in melting operations and sand control necessary. Send resume of education, experience and salary requirements.

BOX 829, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

RETIRED OR RETIRING

Dynamic young centrally located Wisconsin foundry needs the part time consulting service of retired or retiring

MOLD and Core Supervisor
Nonferrous Melting Supervisor
Steel Melting Supervisor

Send complete resume to:

BOX 810, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOUNDRY FOREMAN

For a medium-sized, semi-mechanized gray iron foundry located in the East.

State experience and salary expected.

All replies confidential.

BOX 819, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOREMAN—CORE MAKING

A northern Ohio steel foundry wants foreman for Core Department. Write personal data, salary desired and resume of experience. Address: Box 806, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY ENGINEER

Challenging position in management engineering for young foundry engineer prepared to travel. Must know gray iron foundry operations, able to make layout drawings. Industrial engineering experience desirable. Reply with photo and state age and salary required. Address: Box 808, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

WANTED

Experienced estimating engineer for work in a nonferrous foundry. Located in Massachusetts. Must be familiar with sand casting process. Address: Box 740, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

GRAY IRON FOUNDRY SUPERINTENDENT

To supervise all operations of a jobbing and production gray iron foundry of sixty employees. Must be well versed in foundry fundamentals and able to organize, train and lead the work force. Address: Box 812, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

Foundry Consultant

FOUNDRY—CORE ROOM CONSULTANT

WANTED! Jobbing, semi and high production foundry managements interested in reducing core room manhours with increased production. If you desire to reduce you core room manhours by 20-60% with increased core production, circumvent high cost and competition, act today! Contact us for the latest methods in conventional green sand and shell core blowing methods. For consulting service. Address: Box 828, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

Employment Service

FOUNDRY PERSONNEL SPECIALISTS
National Placement and Procurement of

GENERAL AND PLANT MANAGERS, PLANT SUPERINTENDENTS, FOREMEN—ALL DEPARTMENTS, METALLURGISTS, ENGINEERS, CONTROLLERS, ACCOUNTANTS, SALESMEN, SALES MANAGERS, PERSONNEL DIRECTORS, PURCHASING AGENTS.

Confidential Inquiries Invited
From Employers and Qualified Applicants.

For Fast Competent Assistance Contact
DRAKE PERSONNEL, INC. HARRISON 7-8600
JOHN COPE, DIRECTOR 220 SOUTH STATE ST., CHICAGO, ILL.

SALARIED PERSONNEL

$5000-$30,000. This reliable service, established 1927, conducts confidential negotiations for high grade men who seek a change of connection under conditions assuring if employed full protection to present position. Send name and address only for details. Personal consultation invited. Address: JIRA THAYER JENNINGS, P. O. BOX 674, MANCHESTER, VERMONT.

Positions Wanted

FOUNDRY EXECUTIVE

Thirty-eight year old Mechanical Engineer, 16 years' foundry experience in ferrous and nonferrous high production foundries. Shell molding experience—extensive experience in foundry mechanization, design of foundry equipment, foundry layout and methods. Desire midwest. Address: Box 782, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

EXECUTIVE

Experience in all phases of foundry operations and management. Thorough knowledge of machine shop, pattern shop, engineering, metallurgy, foundry cost and estimating, sales and industrial relations. Registered mechanical engineer, 25 years' experience foreman, superintendent, general manager and vice president. Foundry running 150 tons daily. Address: Box 802, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY FOREMAN OR SUPERINTENDENT

Twenty-five years' practical, technical and managerial experience in captive and jobbing foundries. Acid and basic electric iron, steel and all alloys. Melting, molding, core and cleaning department supervisory experience. Centrifugal castings. Top quality castings and efficient operation. Age 42. Excellent references. Address: Box 826, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT OR WORKS MANAGER

Thirty-two years' practical experience, ferrous and nonferrous, jobbing and production. Fully qualified to take complete charge all foundry operations. Iron by analysis, high and low carbons, also brass, bronze, aluminum. Have held superintendent positions for past 25 years in Pennsylvania and Alabama. Can also make green sand castings look like the shell castings which are made in shell molds. Address: Box 767, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRYMAN

Foundry Engineer, age 36, with broad operating and engineering experience in jobbing and high production covering steel, malleable, and iron, seek connection with good progressive organization. Go anywhere. Address: Box 811, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

WORKS MANAGER—SUPERINTENDENT

Capable of operating a 350 man organization, 23 years of experience in casting ferrous and nonferrous metals in sand, permanent and investment molds profitably. Address: Box 792, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT FOREMAN

Desire position in gray iron or nonferrous, jobbing or production. Well versed in all phases of foundry operation. Practical and Technical. Fifteen years in supervisory positions, available immediately. Address: Box 752, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRYMAN

Sixteen years' experience, supervisor-engineer. Well versed in all phases of foundry production on small and medium high production ferrous castings. Will consider employment anywhere. Address: Box 820, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

Representatives Wanted

SEVERAL EXCLUSIVE TERRITORIES

For aggressive organizations now calling on foundries, all types. No supply houses wanted unless you offer capable equipment engineering and service. Nationally advertised, well known line includes shell molding equipment, core blowers, core draw machines, combination blower and draw machines, molding machines, miscellaneous foundry equipment, custom-building and testing equipment. Liberal commissions. Address: Box 793, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SALES REPRESENTATIVES

Through our advertising in FOUNDRY and other trade magazines, we are receiving inquiries for our strainer cores, pouring pipes and other ceramic specialties. We require experienced sales representatives to contact these interested prospects and introduce our line of products to all foundries in several good territories. Please give detailed information about yourself and other lines handled in first letter. Address: MR. C. L. EVANS, UNIVERSAL CLAY PRODUCTS CO., SANDUSKY, OHIO.

Opportunity

PERMANENT MOLD METHOD AVAILABLE

THE WAGNER PERMANENT MOLD CO., 2910 Empire Ave., Burbank, California, has developed a Permanent Mold Method for ferrous and nonferrous metals and invites inquiries from any country regarding this method and process.

Wanted-To-Buy

WANTED

1—50 KW TOCCO Single Station Induction Heating Unit.
1—50 or 100 KW Induction Melting Furnace, or Generator if available.
1—60# DETROIT ELECTRIC Melting Furnace

UNIVERSAL MACHINERY & EQUIPMENT CO.
320 EAST BROAD ST.
SHILLINGTON, READING, PA.
PHONE: READING 7-1321

WANTED

15 TON OVERHEAD CRANE
WITH 5 TON AUXILIARY
TO SPAN 56.5' OR MORE
MUST BE CAB CONTROLLED
EQUIPPED FOR 440 VOLT
3 PHASE 60 CYCLE

SIMPLICITY ENGINEERING COMPANY
DURAND 3, MICHIGAN

MIXERS WANTED

Used Simpson Intensive Sand Mixers. State size, condition and lowest cash price or immediate acceptance. Address: Box 578, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

CLASSIFIED ADVERTISING

Accounts Wanted

ACCOUNTS WANTED

Equipment and supply company, covering state of Wisconsin with good following, desires additional lines. Interested in heavy equipment, melting furnaces, flasks, etc. Address: Box 825, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

Foundries For Sale

FOR SALE OR LEASE
GRAY IRON FOUNDRY

Fully equipped job-shop with No. 4 Cupola; 24,000 Sq. Ft. Building on 1 acre of land, 90 mi. SW of Chicago.

BOX 827, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOUNDRY FOR SALE

Small iron foundry fully equipped, with railroad siding, ready to operate. Location: Lincoln, Nebraska. Building and real estate go with business. Sale necessary to settle estate. Address: JOSEPH J. CARIOTTO, FEDERAL SECURITIES BUILDING, LINCOLN, NEBRASKA.

FOR SALE

Small nonferrous foundry in operation; Southern Ohio, or would consider partner. Address: Box 758, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

For Sale

FOR SALE
MOTORS—GENERATORS
TRANSFORMERS
Unused — Rebuilt
WORLD'S LARGEST INVENTORY
ELECTRIC EQUIPMENT COMPANY
Phone Station Collect GLenwood 6783
P. O. Box 51 — Rochester 1, New York

FOR SALE

Johnston & Jennings #1020B Rollover
Minimum Size Flask 24 square
Maximum Size Flask 46 square
Minimum Flask Thickness 21"
Maximum Flask Thickness 45"

D. J. MURRAY MANUFACTURING CO.
1002-1024 Third Street
WAUSAU, WISCONSIN

FOR SALE

Shell Process single stage, Shell Mold Machine complete with bonding fixture and automatic sand feed. 6 months old.

BRONX BRASS FOUNDRY, INC.
1262 Westchester Ave., Bronx, N. Y.

FOR SALE

1—Simpson Mixer #2, 20 HP motor. Miscellaneous: Screens, Pulverizers, Grinders, Tyler Rotap Screens, etc.

Wanted: Your Idle Machinery.

OUR 38TH YEAR.

CONSOLIDATED PRODUCTS CO., INC.
66 BLOOMFIELD STREET
HOBOKEN, NEW JERSEY
HO 3-4425 **N. Y. TEL. BA 7-0600**

FOR SALE

Completely overhauled Roots-Connersville Blower, 3200 CFM; max capacity. Will sell for $1000.00 —F.O.B. Alpena, Michigan. Price does not include motor. Address: THUNDER BAY MFG. CORPORATION, P. O. BOX 317, ALPENA, MICHIGAN.

For Sale

FOR SALE

MOLDING MACHINES

1—Herman, Jolt, Rollover Draw, 6000#, 40" x 60" table.

2—International, Jolt, Rollover Draw, 24" x 10G, Stationary.

2—International, Jolt, Rollover Draw, 20" x 8-G. Portable.

2—No. 275 Osborn jolt squeezers. Stationary.

CORE OVENS

1—Coleman Recirculating 3 section with 5 drawers per section. Gas fired.

1—Coleman Recirculating 4 section with 5 drawers per section. Gas fired.

BLOWERS FOR CUPOLAS AND FURNACES

1—Connersville Rotary Blower, 3500 CFM.

2—#7½ Roots rotary blowers—27 x 81—14000 CFM.

2—Connersville Rotary 14" x 27" HD, 2750 CFM at 5# press.

1—Connersville rotary blower 22 x 66 45 cu ft per revolution 9000 CFM.

Maxon-Premix Blowers for Gas ¼ to 1 HP.

2—2 HP 20-oz. Spencer Turbine Blowers.

2—Spencer Turbine Blowers, 3000 CFM, 24 oz., 30 HP, 3/60/220-440 V.

METAL MELTING EQUIPMENT

1—1000# open flame brass melting furnace, gas fired.

1—Hausfeld Stationary Brass, oil or gas burner, 2000# cap.

1—Hausfeld Tilting crucible, gas, 250# Al, Cap.

1—Hausfeld 2000# aluminum capacity furnace, barrel type, open flame, oil fired.

MISCELLANEOUS

1—Beardsley & Piper Model S Screenerator.

1—Pangborn 1 to 4 nozzle air blast generator, complete.

1—Sullivan, 2 stage compressor, 14-8¾ x 10, 75 HP.

1—Sly Tumbler 24" x 40".

1—International SB-11 core blower.

2—Pangborn cloth screen collectors. 2 HP.

1—Stoney crane type shakeout.

1—NPD Royer sand separator.

1—#16 Roto-clone unit complete.

Complete stock of rebuilt mill and dust exhaust blowers.

CLIFTON MACHINERY COMPANY
1023 W. SIXTH ST. CINCINNATI 3, OHIO

FOR SALE

Air Hoists never used I. R. model "C" one ton cap. 15' lift. List price approx. $655.00, sale price $425.00.

Thor model #1020 never used 1,000 lb. cap. 20' lift. List price $455.00, sale price $295.00.

HAYNES EQUIPMENT CO., INC.
62 VOORHIS LANE
HACKENSACK, N. J.

FOR SALE

Following items from modern mechanized foundry: Coleman tower core oven 9'2" x 8'8" x 24'; overhead sand handling and conditioning system; vibrator shakeout conveyor 90'; production shell molding machine and equipment by Shell Process, Inc.; #1 Demmler core blowers; melting furnaces various types; other miscellaneous foundry and core equipment. Address: **BARNES MFG. CO., MANSFIELD, OHIO.**

For Sale

FOR SALE

American Wheelabrator Tumblast 36" x 42", complete with Dust Collector and controls	$3250.00
American 48" swing table, complete, unused	3500.00
American No. 1A Tablast 7-14" multi-tables	900.00
Tabor 10" power molding machines	110.00
Tabor 10" jolt squeeze swinghead	225.00
Osborn 2047-4 jolt rollover pattern draw machines, size of table 17" x 24", 8½" draw	200.00
Furnace Carburizing 1750°, 20" x 36" deep pit carburizing Leeds & Northrup, complete	3500.00
Preheat oven 6' wide x 6' deep x 4' high, 600° F. complete, unused	1500.00
Burring Booth Newcomb Detroit magnesium, 15 HP motor, unused	1200.00
Uniwash dust collector, 5600 CFM, Newcomb Detroit, 10 HP, 3/60/220	1000.00
American Rotoclone Dust Collector, sludge type, 2500 CFM 5 HP, 3/60/220	750.00
Core Oven 10' x 7' x 4', Gehnrich with controls	350.00
American Dustube No. 185, capacity 16950 CFM with 25 HP motor and blower	1800.00
American Dustube No. 65, complete	700.00
Suction Cabinet, McLeod 5' x 3'	275.00
Detroit Brinell Hardness Testers	150.00
Tinius Olsen tensile testers	100.00
Vertical disc grinder 30" Gardner, 7½ HP	600.00
Wire Cutter Climax ¼—3/16	250.00

M. ELSTEIN
426 GRAND STREET
JERSEY CITY 2, NEW JERSEY

SAND BLAST EQUIPMENT
WE BUY SELL TRADE

15" Continuous Wheelabrator	$3,000.00
42 x 48 Wheelabrator Tumblast	2,500.00
36 x 42 Wheelabrator Tumblast	3,000.00
27 x 36 Wheelabrator Tumblast	2,500.00
15 x 20 Wheelabrator Tumblast	1,600.00
1½ cu. ft. Pangborn Air Blast Barrel	
Pangborn 9' L. G. Table (Side Throw Wheel)	4,500.00
Pangborn 6' L. G. Table	2,500.00
Pangborn E. S. 421 Shell Blasting Machine	3,500.00

Horizontal and Vertical tumbling barrels, Hand cabinets, and dust collectors. All types and sizes. Reasonable.

ATTENTION CANADIAN BUYERS

We still have two 42 x 48 Wheelabrators in Canada. These can be purchased duty free. Priced at $2,500.00 and $3,000.00. Excellent Condition. Also 42 x 48 Wheelabrators in Detroit need repair at $950.00 and $1,500.00.

DIAMOND SAND BLAST INC.
4654 West Jefferson Ave.
Detroit 9, Michigan
Phone Vinewood 3-6750.

FOR SALE
TURBO BLOWERS WITH MOTORS

CFM	PRESS.	MAKE	CFM	PRESS.	MAKE
8375	20oz.	Spencer	380	16oz.	No. Am.
6000	32oz.	Ing.-Rand	340	20oz.	A-B
4700	32oz.	Ing.-Rand	320	12oz.	Spencer
2700	16oz.	Spencer	250	12oz.	No. Am.
2500	7oz.	Sturt.	9000	6"SP	Northern
1150	20oz.	No. Am.	3420	8"SP	N.Y.
800	13oz.	Buffalo	2700	⅝"SP	Ilg
500	12oz.	Buffalo	2500	½"SP	American
450	7oz.	Spencer	1100	4½"SP	Bayley
400	16oz.	No. Am.	2344	2"SP	Clarage

THE MOTOR REPAIR & MFG. CO.
1532 HAMILTON AVE.
CLEVELAND 14, OHIO

PUBLIC AUCTION SALE

Modern Late-Type
FOUNDRY MACHINERY & EQUIPMENT

formerly belonging to TAYLOR-FORBES Limited

Guelph, Ontario, Canada (near Toronto)

SALE DATE: JANUARY 10th at 11 A.M. (E.S.T.)

The Majority of Machinery and Equipment in This Foundry was Installed in 1954.

No. 5 "Modern" Cupola; Capacity 6 tons per hour, complete with Modern floor type charger, Atlas 4,000 lb. batch weighing scale, charging bucket, positive pressure blower, with 25 H.P. motor and air-way controls, charging unit designed to service two cupolas. (Installed 1954.)

Tacconne Model TD4 High Production Diaphragm Molding Machine; 28″ x 30″ head, will accommodate 24″ wide x 32″ long x 10″ high flask, (inside dimensions;) Serial No. 605.

No. 30 Beardsley & Piper Speed Muller; 6½ to 13 ton per hour capacity, 4 cubic feet batch, with skip hoist.

19—Osborne No. 275J Jolt Squeeze Molding Machines; 12″ x 20″ platen; (Majority purchased new 1954)

American Wheelabrator Tablast Model BM58536; complete with motors, blowers, ducting and controls.

American Wheelabrator 27″ x 30″ Tumblast.

American Outside Dust Collector.

Core Sand Mixer, paddle type, complete with motor and bucket elevator.

American Wheelabrator 60″ Sand Cutter, riding type, electric motor driven; Serial No. 312.

Champion CB10 Core Blower.

Champion CB5 Core Blower.

Tower Type Continuous Core Oven, combination oil and gas fired, complete with recirculating type air heater.

Hough Payloader, 12 cubic feet bucket, equipped for fork attachment, elevating capacity 1250 lbs.

Bell "Prime Mover" Motorized Wheelbarrow, 1500 lb. capacity.

4—Tumbling Barrels 30″ x 60″, tandem drive.

1200 feet Monorail, complete with switches.

Ingersoll Rand 1,000 lb. and 2000 lb. Air Hoists.

Chain Hoists. Pouring Devices. Roller Conveyors. Portable Crane. Wheelbarrows. Hauck Oil Fired Torch with tank.

Quantity of Hines Free-Mount Aluminum Flasks, various sizes.

Large quantity Cast Iron Flasks. Also bottom boards and bands.

Hand and motorized Sand Riddles.

Sprue Cutters. Cleveland Vibrators. Air Rammers. Misc. Molding Machines. 6—Bull Ladles.

Foundry Laboratory Test Equipment

Optical Pyrometer.

Ashworth Speedy Moisture Tester.

Dietert Permeability Tester.

Dietert Compression Tester.

Laboratory balance scales, etc.

SAND SYSTEM—Consisting of No. C920 Clearfield Sand Muller; 50 ton sand storage hopper, bucket elevators, sand belt conveyors, six sand hoppers for molding stations, car type mold conveyor with drive, shakeout, all complete with necessary steel supporting structure.
(The above will be offered as a unit or in separate lots.)

Machinery Sold Piece by Piece—No Confirmation Necessary

IMMEDIATE DELIVERY

Inspection: JANUARY 5th to Date of Sale!

Write, Wire or Phone for Descriptive Circular.

MEYER GRONIK CO.
INDUSTRIAL AUCTIONEERS
135 W. Wells Street Milwaukee 3, Wisconsin

For Sale

FOUNDRY EQUIPMENT AVAILABLE—IN STOCK

Jolt Squeeze Strip Molding Machines

720 PJ Osborn 31 x 44 table, 20″ squeeze cylinder.

#724 PJ Osborn; 38″ x 56″ table; 24″ squeeze cylinder; 11″ jolt cylinder; 10″ draw with hopper; 9″ squeeze stroke; 4000 lb. cap. new in 1948; excellent condition; extra large size.

#163 Milwaukee—Table size 16″ x 28″; actual capacity 16″ x 44″; frame lift type; 1500 lb. capacity; also #143 and #183 Milwaukees.

Nicholls—Type B; 1945 machine; 14″ cylinder; 14″ x 36″ table.

213 SPO 19 x 26 table, 4½ jolt cylinder, 13″ squeeze.

214 SPO 14 x 24 table, 14″ squeeze cylinder.

Jolt Stripper Molding Machines

559 Osborn 25 x 30 table, 1200 lb. jolt capacity.

Jolt Rollover Molding Machines

#918 Johnston & Jennings—44″ x 54″; 18″ draw; no pit required.

International—Type F; Table size 31″ x 12″.

Osborn Power Rollovers—Model 2047-4; Cap. 18″ x 24″; stationary; 1942 machines.

Osborn #601; 750 lb. jolt capacity; 30″ overall flask length.

Osborn #602; 750 lb. jolt capacity; 36″ overall flask length.

Osborn #605; 750 lb. jolt capacity; 54″ overall flask length.

SPO—Model #914; 14″ cylinder; 30″ capacity.

Tabor 30″ x 40″, extends to 69″, 12″ draw, shockless type, 1500 lb. cap.

Jolt Squeezers

Nicholls Type D Jolt Squeezer.

Osborn #275 J Jolt Squeezers; table size 16″ x 20″; 10″ squeeze cylinder diameter.

Osborn #276 jolt squeezers.

Push Off Machines

Champion Push off machine; Model LLA-45; table size 45″ x 26″; used with sand slinger.

International Push off machine; Model LP—Portable pin lift; used with sandslinger.

Core Blowers — Core Rollovers — Core Draw Machines

#193 Osborn — for medium sized cores; equipped with air operated draw pistons.

#94 Osborn—for large cores.

Osborn Hand Rollovers—Model 42; table size 14″ x 20½″; maximum width of Core Box —22″.

Material Handling Equipment

Model HA Hough Payloaders—Rebuilt.

Clark Fork Lift Trucks—6000 lb. Capacity.

Lewis-Shepard Platform Lifts—6000 lb. capacity.

Baker Raulang Fork Lift Truck—6000 lb. with ready power unit.

Elwell Parker Fork Lift Truck—6000 lb. with ready power unit.

Yale Fork Lift Truck—6000 lb. with ready power unit.

Mercury Fork Lift Truck—2000 lb.—Electric.

Furnaces

Stroman 2000 lb. Tilting Hydraulic; New in 1944.

Core Ovens

Dielectric—Model 900A and 1800A.

Miscellaneous Foundry Equipment

U. S. 7½ HP 3 speed grinders; 28″ wheel.

#50 Beardsley & Piper Speedmuller.

Model S Beardsley & Piper Screenerators.

Climax Wire Straightener—#2; capacity ¼″ to ¼″; Ser. CWS 600-44.

Royer Screenerator.

FOR THE BEST DEAL CALL

BALCHER MACHINERY COMPANY
6020 EUCLID AVENUE
CLEVELAND 3, OHIO
TELEPHONE: EXPRESS 1-8930

For Sale

FOR SALE
FOUNDRY EQUIPMENT

Porbeck Core Oven with automatic controls. Demmler #55 Core Blower, Redford Bench Core Blower, #3½ Beardsley & Piper Mulbaro, Royer Portable Sand Conditioner and Separator, three gas-fired Campbell-Hausfeld Melting Furnaces, Simpson Sand Mixer Muller, three Milwaukee Jolt Squeeze Machines, one Milwaukee Jolt Squeeze Strip Molding Machine with automatic swing head, two Porter-Cable Precision Automatic 8" Wet Belt Grinders.

Also conveyors, bins, shakeout, sand testing equipment and other miscellaneous items.

All of the equipment is only a few years old in good condition.

CLAY & LAMBERT MFG. Co.
1701 DIXIE HIGHWAY
LOUISVILLE, KENTUCKY

CONVEYORIZED FURNACES
FOR SALE, RENT OR LEASE

Gehnrich Slat Belt Conv. Recirc. Draws, 1000°F
Holcroft Slat Belt GF Recirc Draw, 35" w x 14" h x 24' l
Industrial Heating GF Mesh Belt, Recirc 1250°F
Bellevue Continuous Muffle Type GF for 2000°F Elect. Furnace Mesh Belt Brazing 2100°F with Generator
GE Roller Hearth 858 KW for 1800°F, 60"w x 18"h x 35'l

COMPLETE HEAT TREATING PLANTS, GOOD GOING BUSINESSES IN VARIOUS SECTIONS OF THE COUNTRY. ALL OR PARTS!

Please call "COLLECT" TOwnsend 8-8450

METAL TREATING EQUIPMENT EXCHANGE
9825 GREELEY
DETROIT 11, MICHIGAN

FURNACES FOR SALE

Ten used heat treating furnaces and two 7-ton gantry cranes. Good condition, priced to sell. Address: BAER STEEL PRODUCTS, INC., BOX 1428, BOISE, IDAHO.

For Sale

FOR SALE

One 3-ton Heroult Electric Arc Furnace with General Electric 1500 KVA Transformer, 11,800 volt primary—150-90. New control panel, new cable and all electric parts.

25 sets heavy steel flasks, 41" x 47", 18" cope, 8" drag.

30 sets 30" x 30" flasks, 14" cope, 8" drag.

7 sets 46" x 50" steel flasks, 15" cope, 15" drag. These flasks are made by Shanafelt and have never been used. Can be bought cheap.

BOX 764, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOR SALE

2—CUPOLAS, 68" O.D. FULLY EQUIPPED WITH ELBOW TUYERES, SKIP HOISTS, SPENCER TURBINE BLOWERS, 50" O.D. FORE HEARTHS AND FOXBORO INSTRUMENTATION. PURCHASE CAN BE NEGOTIATED VERY REASONABLY.

BOX 817, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOR SALE

2 Model A Rotary Mold Conveyors, Size 10' Diameter
1 Model A Rotary Mold Conveyor, Size 12' Diameter
6 Model A Rotary Motorized Mold Conveyors, Size 16' Diameter and drive
1 Simpson Porto Muller

ATTWOOD BRASS WORKS, INC.
GRAND RAPIDS 2, MICH.

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FOR SALE

We have the best selection of HARD CHROME REBUILT PNEUMATIC TOOLS WE HAVE EVER HAD.

Ingersoll-Rand Size 24 Floor Rammers
Ingersoll-Rand Size 14 Floor Rammers
Cleco Bench Rammers
Chipping Hammers—All types
Core Breakers and Grinders

Our prices are about half the cost of new tools.

All tools sold by us are guaranteed and can be returned if found not satisfactory.

CENTRAL PNEUMATIC SERVICE COMPANY
512 LINDEN AVE., DAYTON, OHIO
TELEPHONE: MADISON 2701

FOR SALE

Lectromelt 250 lb. Type "U" Side Charge Electric Furnace—Complete —Good Condition.

BEAVER VALLEY ALLOY FOUNDRY CO.
MONACA, PENNSYLVANIA

ELECTRIC

Melting Furnaces
LARGEST STOCK IN THE COUNTRY

1—Swindell 8 ton 9' diameter Shell Electric Furnace, 2500 KVA transformer, 13,800 or 11,000 V. In our Chicago warehouse.

Swindell Electric Furnace, 5' dia. shell, 350 KVA, 6600 volts.

Swindell Electric Furnace, 4' dia. shell, 250 KVA, 6600 volts.

Swindell Electric Furnace, 5' dia. shell, 500 KVA, 6600 volts.

Allis Chalmers Induction Melting Furnace, 2-600# pots.

Ajax Northrup High Frequency Induction Furnace, spark gap type, 35 KVA with 60# and 17# melting pots.

1—Detroit Electric, 1500# capacity, 13,200 primary voltage. Kuhlman transformers. Complete with controls.

Detroit Electric 350#, Type LFA with Kuhlman transformers and oil circuit breaker, 13,200 primary voltage.

Pennsylvania 1500 KVA transformer, 12000 V. Never used since rebuilt. With complete controls, mostly new, needed for operation of a furnace. New control panel, Field Rheostat, 25 HP, 440 V MG set.

1—1500 KVA G. E. Transformer with taps for 11,000 or 13,800 volts.

Transformers—2—2500 KVA furnace transformers, 11,000 or 13,800 primary voltage.

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Best wishes for the

holidays

and

the coming year.

AAA Machinery and Equipment Co.

15539 Saranac Ave. • Cleveland 10, Ohio

SPECIAL

We have made a fortunate purchase of several carloads of late type Foundry Equipment near Detroit—It is offered at special prices before removal to our Chicago Warehouse.

6—CORE GRINDERS, Milwaukee 70-9
1—American CORE ROD STRAIGHTENER
8—OPTICAL PYROMETERS
1—Simpson LABORATORY MULLER

3 COLEMAN HORIZONTAL GAS FIRED continuous CORE PASTE or BLACKING OVENS. Can be moved without dismantling, 28′ x 5′ x 5′.

2—Bench type REDFORD CORE BLOWERS
1—Redford #2
1—Demmler #2
1—Demmler #3E
1—International SB11
1—International SB13
3—Osborn 193
2—Fox #6—15 hp Swing Frame GRINDERS

3—Royersford 42″ x 72″ Late Type Chain drive TUMBLING BARRELS, 10 hp motors.
1—Sly 42″ dia. x 56″ Tumbling Barrel
1—Sly Square 42″ x 42″ x 64″ Barrel

1—B&P Stationary Sand Slinger
4—Milwaukee 165 Jolt Squeeze, Pin Lifts
3—Milwaukee 620ND Strippers

SAND BELT CONVEYORS
160′-30″ with drives
144′-30″ with drives
123′-30″ with drives
47′-36″ with drives

B & P 70 Mullor, late type

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WORLD'S LARGEST INVENTORY OF GUARANTEED FOUNDRY EQUIPMENT

AIR HOISTS

12—**INGERSOLL-RAND** LC-7 Air Bloc Type, 700 lb. cap., w/ link chain.
83—**INGERSOLL-RAND** RC-5 Air Bloc Type Air Hoists, 500 lb. cap.
25—**INGERSOLL-RAND** Air Hoists, Sizes A, B, C, D, D-6 and E, 500 to 10,000.
5—**CHICAGO-PNEUMATIC** 2-3-5 ton cap.
8—**DETROIT,** 1 to 5 ton cap. Air Hoists.

BUCKET ELEVATORS

1—**LINK BELT** 40' Centers, Size 14" x 7" 41 tons per hour.
1—**LINK BELT** 50' Centers, Size 16" x 8" 60 tons per hour.
1—**HANDY-SANDY** HS-7-G—Single Hopper

CORE BLOWERS

4—**CHAMPION** #CB-400 & CB-10
16—**DEMMLER** Models 1, 2, 2E, 2K, 3, 3E, 4, & 4E.
4—**INTERNATIONAL** SB11 & SB-13
7—**OSBORN** #92, 192 & 193.
6—**MILWAUKEE—TACCONE** A-3

CUT-OFF SAWS & STRAIGHTENERS

1—**TABOR C10AF**—16" Wheel, 10 HP.
1—**DEWALT** Model Me2V Foundry Type
2—**CLIMAX** #2, 3 Wire Straighteners.
2—**TESSMER** "H" & "I" Sprue Cutters.
1—**AMERICAN** Type D—¾" x 1¼" Shear.

CORE OVENS

1—**INDUCTION** Dialectric Model M-800A.
1—**INDUSTRIAL** Continuous Type, trays 18" x 80" long, gas fired recirculating.
1—**DETROIT** Vertical Tower 45' high, racks 14" w x 60" long, 31". Centers.
1—**YOUNG BROS.** 2 Compartment. 10 drawer type. Size 9' x 12' x 8'—Gas fired.

CORE GRINDERS

1—**MILWAUKEE** Rotary Type Model 70-12 70" Diameter w/motor & electrical.

CUPOLA BLOWERS

1—**ROOTS-CONNERSVILLE,** size 20 x 24, Type HD w/50 HP motor, etc. 7½ HP.
1—**INGERSOLL-RAND** Centrifugal Type FS-367 with 100 HP motor.
1—**INGERSOLL-RAND** Type FS-357, 7000 CFM w/60 HP motor.

DUST COLLECTORS & ROTO-CLONES

1—**PANGBORN** #423 CH, Bag Type, 3240 CFM.
1—**AMERICAN AIR FILTER** No. 14 Type W arrangement "C" with sludge ejector.
1—**AMERICAN AIR FILTER** No. 27 Type W arrangement "C," with sludge ejector.
1—**AMERICAN AIR FILTER** Type N, Size 10 with Bench.
1—**AMERICAN AIR FILTER** Type N. Size 20, 20,000 CFM, with 75 HP motor.
1—**AMERICAN AIR FILTER** Type N, Size 24, 24,000 CFM, 75 HP motor.

ELECTRIC MELTING FURNACES

5—**DETROIT** Type AA Rocking 750 to 1000 lbs, w/250 KVA Transformers.

GAS & OIL FIRED FURNACES

6—**LINDBERG-FISHER** MNP Size 1700
18—**LINDBERG-FISHER** Type SSH,
3—**LINDBERG-FISHER** MNP Size 2400
1—**LINDBERG-FISHER** MNP Size 225
2—**LINDBERG-FISHER** Type BBI, #225
11—**HAUSFELD** #200 Crucible, stationary,
1—**STROMAN** Model NP, 125-175 Crucible,
2—**CAMPBELL-HAUSFELD** IPNT Iron Pot Type, 2000#'s Cap. gas or oil.

GRINDERS—SWING—SNAGGING

1—**HAMMOND WR-1** Double End Snag, wheel 24" x 3"—10 HP motor.
1—**U. S.** Electric Swing Frame, 15 HP, 2 speed, wheel 24" x 3" x 12".
6—**U. S. ELECTRIC** #65 Snag Grinder, 15 & 20 HP—4 speeds, wheel 24" x 3".
2—**U. S. ELECTRIC** #64 Snag Grinders, 7½ hp. adjustable speed, wheel 14" x 3".
1—**MARSCHKE** 3 HP Swing Grinder.
3—**FOX** #6 Swing frame 15 HP.
1—**MUMMERT-DIXON**—Swing Frame 5 HP.

LADLES

6—**INDUSTRIAL** Lip Pour 24" x 24"
4—**MODERN** 1500 lb. Cylindrical Type,
1—**WHITING** 10 ton lip pour, enclosed gear.

INDUCTION MELTING—HEAT TREAT

1—**LEPEL** 30 KW Spark Gap Converter.
1—**LINDBERG** Model 4860 GH, Cyclone Type gas fired, with all controls.
1—**GENERAL ELECTRIC** 1250 kva Induction M.G. set 300 cycles, with 1850 HP
1—**GENERAL ELECTRIC** 300 KW Induction MG Set, 2520 cycles—450 HP.
1—**LOFTUS ENGINEERING CORP.** Annealing Furnace, walking beam, gas fired, recirculating, 1600°, 45' long x 10' wide x 12' high. NEW 1951.

MOLDING MACHINES

Jolt Squeezers

16—**OSBORN** #275J—Table 16" x 20"—Portable and Stationary.
10—**SPO** #110J—Table 17" x 20"—Port.

JOLT ROLLOVER PATTERN DRAW

1—**B & P** Model 920RCX Rol-A-Draw
1—**DAVENPORT** #40SA—Table 42" x 50" —3000# Jolt, 18" Draw.
2—**HERMAN** 6000# Series, 42" x 78" Table, 20" Draw.
1—**INTERNATIONAL** G, Size 24" x 10".
1—**INTERNATIONAL** G, Size 30" x 12".
10—**INTERNATIONAL** R Size 14" x 8" for Core Work
2—**JOHNSTON & JENNINGS** #815, Table 30" x 40", Draw 15". 1500# Jolt.
1—**MILWAUKEE** #167, Table 32" x 33", Draw 12", Jolt 1000#. Sq. cyl. 16".
1—**OSBORN** #342, Table 23" x 38".
2—**OSBORN** #405, Table 57" x 64", Draw 26", 3000# Jolt.
1—**OSBORN** #442—Table 21" x 31"—Port.
1—**SPO #413-D,** Table 24" x 25", Draw 10", Jolt 600#. Sq. cyl. 13".
1—**SPO** #508, Table 28" x 30", Draw 9".
2—**TABOR,** 22" x 32" Table, 10" Draw.
1—**TABOR** 30" x 40" Table, 12" Draw.

JOLT SQUEEZE PIN LIFT

1—**INTERNATIONAL** PKL, Size 12"x5½".
1—**MILWAUKEE** 125-3, Table 21" x 27", Jolt 1200# Draw 8".
2—**OSBORN** 710J, Table 16" x 25" Port.
4—**OSBORN** 716PJ, Table 22" x 34", Draw 7", Sq. cyl. 16".

JOLT PIN LIFT

1—**DAVENPORT** 40 AJS, Draw 18".
1—**INTERNATIONAL** JDP Size 600 x 8" draw.
1—**INTERNATIONAL** LP-10, Table 30" x 30".
1—**MILWAUKEE** #1536, Table 32" x 38".
2—**MILWAUKEE** #620 ND 24"x30" Table.
3—**OSBORN** 559, Table 25" x 30", Draw 6".
1—**OSBORN** 563-9, Table 55" x 63", Draw 12".

MATERIAL HANDLING (EQUIP.)

1—**FARQUHAR** 18" x 35' portable Trough.
1—**ELECTRIC BRIDGE** Crane, 25' span, with 2 ton R & M Hoist, 150' track.
1—**JEFFREY** Trough Belt Conveyor, 75' centers, belt 24", with motor drive.
1—**JEFFREY** Trough Belt Conveyor, 103' centers, 24" wide, motor & drive.
3—**LOUDEN MONORAIL SYSTEMS,** "Super Track" (1) 110' of 6" I-beam & two 20' bridges (2) 140' of 6" I-beam & two 12' bridges (3) 130' of 11" I-beam & two 30' bridges; all complete.
1—**SIMPLICITY** Model OA-10-JA—24" x 16' long Vibrating Conveyor.
1—**JEFFREY** 24" x 117' Steel Apron Conveyor.
3—**SIMPLICITY** Model OA-10-A Vibrating Conveyors 3'-6" wide x 15' long.
1—**WHITING** 5 ton Overhead Crane, 50' span, cab operated, AC.
1—**SHEPARD NILES** Overhead Crane. 66½' span, 15 ton cap.

SAND MULLERS

BEARDSLEY & PIPER
1—#30 w/Skip Hoist & Dust Hood, 20 HP
1—#50 w/Skip Hoist, Dust Hood, 50 HP.
1—#70 w/Dust Hood—100 HP motor.
1—#3½ **MULBARO** W Spare Barrow.
CLEARFIELD
1—#404 Batch 4 Cu. Ft.
1—#930 Batch 30 to 40 Cu. Ft. 9' Pan—
SIMPSON
1—#1 Style B, Single Wheel, 400# Batch.
1—#3 Style C, Enclosed Gears—3000#
1—**BLYSTONE** Paddle Type Mixer, 5 HP.
1—**BAKER PERKINS** #16½ Double Paddle Type 21½ cubic ft cap.—30 HP

SAND PREPARATORS

1—**PEKAY** Aerator Model 320-3.
6—**B & P** Screeenerators, "S", "M" & "L".
8—**ROYER** models, NC-2, NDP, C-2, portable.
1—**B & P** #40 Portable.

SAND CUTTERS—"AMERICAN"

1—Model BD—Size 75/60.
1—Model M—Size 99/80.
1—Model M—Size 89/70.

SAND SLINGERS

1—**B & P** 19" Tractor Type, 13' arm.
1—**B & P** 16" Tractor Type, 13' arm, magnetic tower, 4' ramming 4" tip.
2—**B & P** Model 16S-DB Stationary Type 16" Head.
1—**B & P** Stationary—Double Belt Model 5' arm, 4' Ramming, 19" Head, 4" Tip NEVER USED.
1—**B & P** 8 Ton Roto-Feed, 7' Dia. Sand Bin, 8' Dia. Feeder Plate. NEVER USED.

SHAKEOUTS & SCREENS

4—**SIMPLICITY** 4' x 8' Model D. 16,000#.
1—**ROYER** Combination Shakeout & Sand Conditioning unit, serial #ST-47.
4—**SIMPLICITY** 4' x 6' Model B, 5000#.
1—**SIMPLICITY** 4' x 10' Model D.
3—**SIMPLICITY** 3' x 6'—Model BG, 5000#.
1—**SIMPLICITY** 6' x 8' Model DE.
1—**HEWITT-ROBINS** 36" x 78" Vibrex Screen Style M-7.

TUMBLING BARRELS

2—**SLY** 42" x 72" Square, 10 HP.
1—**SLY** 36" x 72" Type C, 5 HP Gearhead
4—**WHITING** 48" x 72", 10 HP Gearhead

WHEELABRATORS & TABLAST

1—**AMERICAN** 42" x 48" Tumblast, with skip hoist. New 1948.
1—**AMERICAN** 27" x 36" Tumblast with skip hoist loader.
1—**PANGBORN** 6 LF Rotoblast Table, 6' Diam. w/dust collector.
1—**PANGBORN** Shot Blast Room 10' x 12' x 14' w/dust collector, elevator etc.
1—**AMERICAN** 36" x 42" Tumblast with Skip Hoist.
1—**HOLLINGSWORTH** Model 44" x 48" Shot Blast.

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AAA MACHINERY & EQUIPMENT CO.

15539 SARANAC ROAD — CLEVELAND 10, OHIO — CALL LI. 1-6545

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EQUIPMENT AVAILABLE IMMEDIATELY

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AIR HOIST	ELEVATORS
APRON CONVEYORS	HEAT TREAT FURNACE
AREATORS	LADLES
BELT CONVEYORS	MOLD CONVEYOR
BLOWER	MOLDING MACHINE
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CORE BLOWER	SHAKEOUTS
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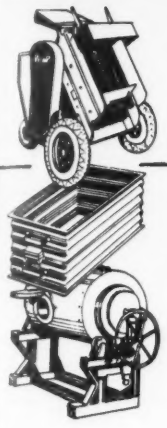

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STEEL APRON CONVEYORS
Midwest—36″ x 120′
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1—Webb heavy duty 356′
109 cars 32″ x 39″
1—Link-Belt 27′ x 70′6″
35 cars 38″ x 72″

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1—Palmer-Bee 40′ centers with unloader. 220-440-3-60.

AIR COMPRESSOR
1—I-R two stage 800CFM
150 H.P. 3/60/220

FLAT BELT CONVEYORS
20″, 24″, 30″, 36″

TROUGHING BELT CONVEYORS
3—24″ x 22′, 24″ x 350′, 30″ x 180′

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2—40′-7″ x 14″ buckets
3—50′-8″ x 16″ buckets

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1—3 ton Bedford—40′ span, 120′ runway
1—3 ton Shepard—Monorail 25HP. 550DC
1—Chisholm Moore Cupola Charging with 200′ monorail—550V. 3/60

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dble end snag—5, 7½, 10 H.P.
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Simplicity—3—3′-5′, 2—4′ x 6′
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Robins-Floatex—1—4′ x 10′

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7—Whirlpool Duplex, 800 CFM, 100″ wide x 65″ deep x 90″ high Buffalo exhausters—7½ H.P. 220/440

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Demmler No. 50, 2, 3, 3E, 4E
International SB11, SB13
Redford Bench—No. 1 & 2

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Beardsley-Piper, #30, #40, #70
Simpson—#1, #2, #3

CUPOLAS
1—#3½ Modern
1—#5 Whiting with skip hoist

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Kane & Roach DX-9
Climax 2½

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1—Bellevue oil fired, all controls box type—36″ x 72″ x 24″
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Ingersoll Rand Type 10—14 x 9 x 12, 2 stage, 75 Hp, 3/60/220/1200 rpm synchronous motor, 350 CFM at 100#.
5 x 5 Ingersoll Rand 10 HP motor.
Ingersoll Rand Type 10, 800 CFM, 2 stage air compressor, 200 HP, 220 V motor. Rebuilt 1952.

AIR HOISTS
8—4000# Ingersoll-Rand, with trolleys.

BLOWERS
Ingersoll-Rand Motor Blower Type FS. Single Stage 4000 CFM @ 3.75 PSI, 100 HP, 220V G. E. Induction motor.
General Electric 7500 CFM, 20 oz., 89.6 Max. HP, 220V motor, Airway controls.
Ingersoll-Rand turbo compressor 10500 CFM @ 20 oz. 85 HP G. E. 220V 3500 CFM motor.

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Sly 8′ dia. Table Shot Blast Unit.
36 x 42 Halloway 7½ HP shot motor elevator and dust collector.

CORE BLOWERS
3—International SB 12.
4—International SB 13.
10—Osborn 193.
1—Osborn 2035-2.
1—Peterson (Similar to Demmler #50).
1—Champion CB 400.

CORE OVENS VERTICAL HORIZONTAL
1—Coleman, combination oil or gas fired 43 carriers 24″ x 90″—1 hour 12 min. to 4 hours 48 min. cycle.
1—Coleman, combination oil or gas fired 43—2 shelf carriers 30″ x 144″ long. 2 hour 12 min. to 7 hour 24 min. cycle. Present replacement cost over $90,000.

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1—Milwaukee 10 ton 40′ span, 22′ lift, 220 V. A.C.
2—Northern 5 ton 40′ span, 22′ lift, 220 V. A.C.
1—Whiting 5 ton 40′ span, 22′ lift, 220 V. A.C.

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Horizontal Disc (Flat) Grinders:
Gardner #186, 30″ dia. disc. 10 HP, 220/440V, with dresser, wet or dry grinder.
Gardner HV5A, 18″ dia., 7½ HP, 440V, with dresser.
Double End Disc:
2—U.S. 18″ wheels, 2 swing tables, 1 with lever feed.

GRINDERS, SNAGGING
2—Hammond 10 WRI Double End Snag. Grinders 20″ dia. wheels, 10 HP 220/440 v motors, variable speed drives.
2—3″ x 24″ U.S. #65, 20 HP 220/440V.

GRINDERS, SWING FRAME
2—3″ x 24″ x 12″ Fox #4, 15 HP.
1—3″ x 24″ x 12″ Marschke, 20 HP.
1—3″ x 24″ x 12″ U. S. 15 HP.

HOT METAL CARRIERS
3—1 ton D.C. Cab operated Cleveland, Monotractor Hot Metal Carriers.

MOLDING MACHINES
Jolt Squeezers:
5—Milwaukee 103-11 Staty. Jolt Squeezers, 13½″ x 20″ table.
7—Champion JS10P Portable Jolt Squeeze molding machine. 18″ x 21″ table.
5—Osborn 275J.
1—Spo 110J.

Jolt Squeeze Pin Lifts BIG
2—International PK 20's. 20″ squeeze cylinder 8″ draw. Ser. #67237. New 1949.
2—Milwaukee Jolt Squeeze Strippers, Model 163-50, 15″ x 24″ table 16″ X open end pattern size.
1—Milwaukee 126-3 Jolt Squeeze Pin Stripper, 27″ x 21″ table, 8″ draw. Portable.

ROLLOVERS
Jolt Rollover Pattern Draw
1—Herman 4000# Series 30″ x 60″ table, 32″ x 48″ bumper.
1—Herman 3000# Series 40″ x 84″ table, special slotted table.
1—Herman 1500# Series 20″ x 36″ table.
2—Herman 750# Series 20″ x 30″ table.
2—Herman 750# Series 20″ x 24″ table.
1—Davenport 24 SA Jolt Rollover Pattern Draw. 26″ x 42″ flask size, 12″ draw.
3—Spo Model 9032.
1—Milwaukee 217.
2—International Type G, Portable, 20″ x 8″ draw.
2—Tabor Portable Rollover 30″

PIN LIFT PUSHOFFS
2—Champion Pin Pushoffs 28″ x 42″ table 10″ draw.

MULLERS AND MIXERS
Simpson #3 Type H open gear type.
Beardsley & Piper #70 Speedmuller. New style cross head.
Royer NC2-45; 15 tons per hour.

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Porbeck Double Car Single door 16′ long 14′ wide 9′ high gas fired 600° recirculating complete with 7½ HP car puller, in place St. Louis, Mo.
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5000′ Jervis B. Webb & Link Belt 658 chain, 4 D.C. motor drive and MG set.

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3—Pouring devices, Whiting 500#.

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1—Model M Screenarator.

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1—Sly 36 x 72

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Hannifin 50 ton hydraulic

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3—7½ HP FISHER, 16 oz.
15—CENTRIFUGAL BLOWERS, 350 CFM to 10,500 CFM.

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1—AMERICAN #1 MULTITABLE, 6 aux. tables 15", main table 45". SHAKEOUT 4' x 6'.
1—AMERICAN #2 MULTITABLE, 5 tables, 37" dia.
5—US GRINDERS, double end, 10, 15, 20 HP.
4—GRINDERS, Swing frame, 15 HP.
2—TUMBLING BARRELS, Cast Iron, 36" x 24" w/2 HP Motor.
2—TUMBLING BARRELS, Square, 34" x 48".
2—TUMBLING BARRELS, Side Tilt, 18" wide x 20" deep.

CONVEYORS
1—LINK BELT Double Deck Oscillating, 80' long x 24" wide, 1954.
1—45' x 24" wide APRON CONVEYOR
4—SAND ELEVATORS, various sizes.
1—STEEL PLATE MOLD, 90' centers, 30" belt, w/drive.
2—STEEL PLATE MOLD, 90' centers, 24" belt w/drive.
6—SAND BELT CONVEYORS, 10' centers to 140' centers, 18" to 36" belt, complete w/drives and hoppers.
2—CASTING CONVEYORS, wire mesh, 18" x 32" w/drive.

CUPOLAS
2—WHITING #6, Complete with Skip Charger.
1—MORRIS #9, w/skip, mixing ladle, never used.
1—MODERN, #3, 46' shell, w/blower.
2—MODERN #7; Blowers & Controls.
1—SKIP CHARGER, 3 bottom drop buckets, scale for #9 cupola.

CORE BLOWERS
1—3K DEMMLER.
1—SB 13 INTL.
6—#2 DEMMLER.
1—CB-400 CHAMPION.
1—#55 DEMMLER.

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150—HINES & FREEMAN ALUM. Pop-offs and jackets, send for list.

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1—500#/hr. MOORE.
1—2000#/hr. LECROMELT.
1—3000#/hr. LECTROMELT.
1—1000#/hr. HEROULT.
2—3000# HEROULTS.
1—3 Ton HEROULT.
1—6 Ton HEROULT.

FURNACES—INDIRECT ARC
1—350# cap. DETROIT, complete.
1—1000# cap. DETROIT, complete.
2—800# BAILEYS.
1—2000# DETROIT, complete.

FURNACES—INDUCTION MELTING
3—333 KW, AJAX-TAMA-WYATT, 1500# Alum.
2—60 KW AJAX, 60 Cycle, 400#
1—7½ KW TOCCO
1—20 KW AJAX Spark Gap High Freq.
1—3 KW AJAX, Lab. type.
1—30 KW LEPEL.

FURNACES—OIL AND GAS
1—FISHER 4 Burner MNP, 1700#, gas.
4—FISHER, Stationary Holding, 500#, gas.
3—WALKER YORK #400 cruc. tilting, coke fired.
1—SKLENAR 600#, Oil fired.
1—HAUSFELD Tilting, 1200# Mag.
1—R & S Convection Draw, Car bottom, 18' l x 8' w x 5' h, oil fired, dismantled, controls.

MOLDING MACHINES
Jolt Rollovers
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1—OSBORN #405, 64 x 50", 18" draw, 3000#.
1—J & J #612, 24" x 30", 12" draw.
2—J & J #815, 30" x 40", 15" draw, 1200# jolt.
1—HERMAN, 8' x 12' Table.
2—HERMAN, 1500#, above ground.
2—HERMAN, 20" x 24", 750#.
1—HERMAN, 40" x 65", 3000#, short arm.
1—HERMAN, 40" x 59", 3000#, long arm.
1—HERMAN, 50" x 72", 6000# jolt.
1—HERMAN, 42" x 78", 6000# jolt.
1—OSBORN, #243, 27" x 40", 20" draw.
4—TABOR, 22" x 42", pattern draw, port.

Bumpers
1—OSBORN #102.
1—HERMAN, 60" x 72".

Jolt Strippers
4—MILWAUKEE #1536, 32" x 38".
4—SPO, 24" x 24".

Jolt Squeeze Strippers
1—OSBORN #175, 21" x 18", portable.
2—MILWAUKEE #163.
1—MILWAUKFE #165, 16" Pin Strip
1—MILWAUKEE #124-6, 12" Pin Strip.

Jolt Squeezers
2—INTERNATIONAL, 17" x 20", port.
1—OSBORN #212 PJ, 17" x 23", stationary.
4—OSBORN #276-J.
3—OSBORN #275-J.
3—TABOR, 18" x 20", 3" jolt, column.
1—TABOR, 18" x 20", 3" jolt, cantilever.
1—ADAMS, 19" x 20" portable.
2—SPO #213-GP
1—SPO #110-J

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2—WHITING 3 Ton. Bottom pour.
4—10 TON BOTTOM POUR, 55" x 55".
2—45 TON TREADWELL, Excellent.
4—800# Worm Geared, Lip Pour
3—1500# TEAPOT, Lip Pour, Worm Geared.
3—5 Ton to 9 Ton, Worm Geared, Lip Pour.
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MULLERS AND MIXERS
1—SIMPSON #0
1—SIMPSON #3, enclosed gears.
2—SIMPSON #2, Unit Drive.
2—CLEARFIELD #404, New 1954.
2—CLEARFIELD #610 and #920.
1—BEARDSLEY & PIPER #60 SPEED-MULLER, 60 HP motor, SKIP-LOADER.
1—B & P MULBARO, #7, extra Base.

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1—FOUNDRY EQUIP. CO., 2 comp., rack, 12'-10" x 15'-8" x 7'-10"; oil, external recirculating.
1—TOWER CORE OVEN, 14" x 60" trays, 45' high, gas fired, dismantled.
2—ROSS 2 comp., rack, gas, 6½ x 14 x 7.
1—PORBECK, 4 drawer, double end, oil.
1—YOUNG BROS. 3 compartment, kiln type electrically heated, with CONTROLS.
1—YOUNG BROS. 2 compartment, drawer type, oil or gas, 82" h x 12' w x 6' l.
1—YOUNG BROS. 3 door, gas, 12' x 8' x 6'-3", recirculating, blower and recorder.
1—COLEMAN, Oil, 2 Comp., Rack Type, Recirc; each comp. 60" wide x 80" high x 14'-6" deep.
1—COLEMAN, Double Door, Oil, Single Comp., Recirc., 60" wide x 14'6" deep x 80" high.

SAND CUTTERS
4—AMERICAN SAND CUTTERS.
1—MODEL "K", 72" reel, Gas Driven.
1—MODEL "F", 80" reel, Gas Driven.
1—MODEL "D", 76" x 96".
1—SANDMASTER, 70 102, New in 1950, Rubber Tires.

SAND LABORATORY EQUIPMENT
1—Complete SAND LABORATORY
1—TEST CORE BAKING OVEN #606.

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1—NEWAGO HANDY-SANDY.
2—JEFFREY SANDITIONERS, Portable.
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1—BEARDSLEY & PIPER TRACTOR TYPE 16" head magnetic separator.
1—PORTABLE SLINGER 16" head, 4' long, on Truck.

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1—TINIUS OLSEN, BRINELL HARDNESS, 3,000 KG.
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1—ALLEN-BILLMEYER Vacuum Cleaner, port.

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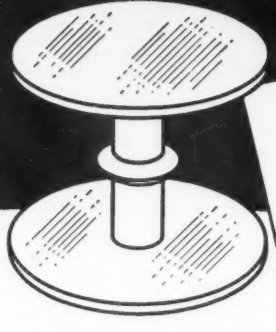

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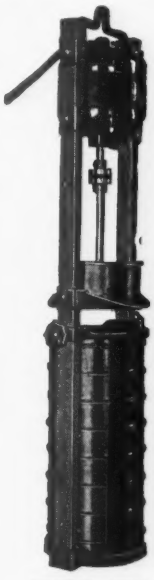

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for sand control
$250.00 (without sieves)

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with 24" square screen and automatic discharge
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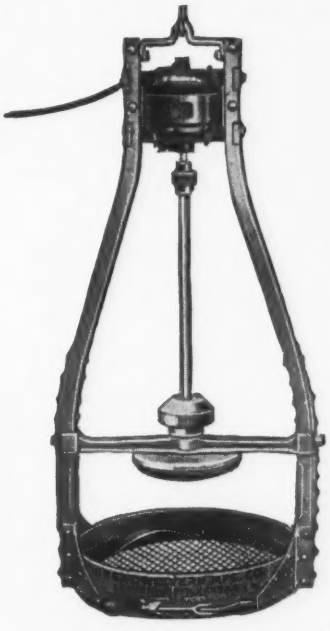

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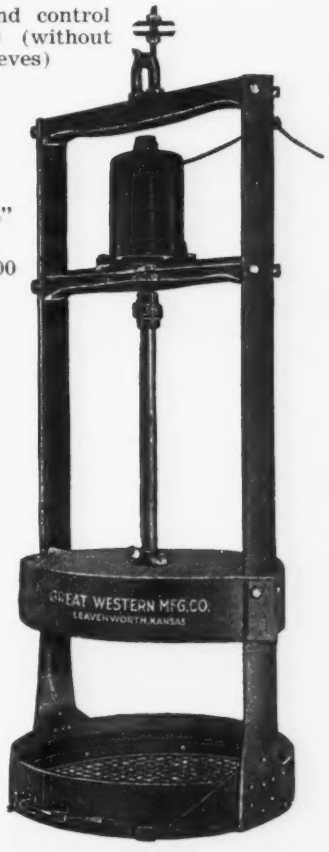
with 20" sieve . . . $275.00

also made with 36" sieve $495.00



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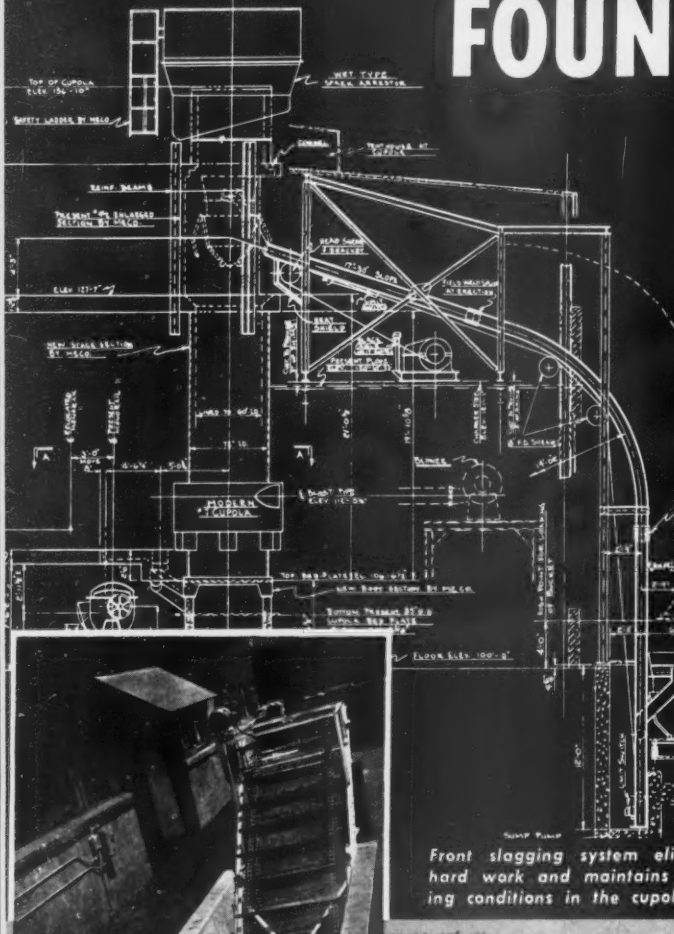
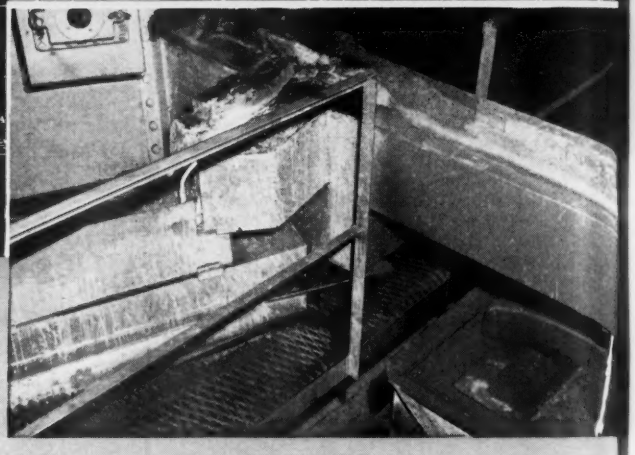


Front slagging system eliminates much hard work and maintains clean operating conditions in the cupola area.



Conveyor at de-watering tank travels 6' a minute.

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Ever since MODERN engineered the first, skip-type, mechanical charger an array of automatic controls has continued to ease the work for foundrymen. From Monday's start to Friday's shake-out the costs of the castings are closely controlled. Push button operation, here at Producto Machine Company, already includes:

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MODERN

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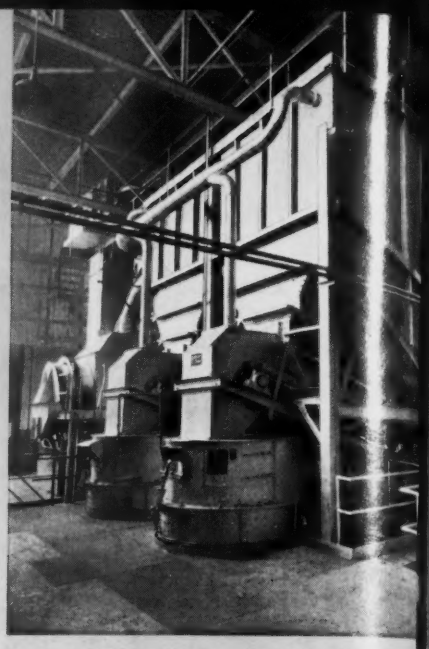

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